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Tourism distribution at competing destinations. Mobility changes and relocation.*

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Abstract
We present a dynamic model of competing destinations to study the agglomeration and dispersion forces driving long-run geographical distribution of tourism. The relative strength of these forces determines whether tourism is agglomerated at one destination or is more disperse. Economies of scale in the tourism industry favour agglomeration while tourists' preference for local tourist attractions and local services is conducive to dispersion. If returns to scale approach constant and tourists do not appreciate local goods, the interaction between the two destinations disappears and our model converges to the well-known Tourism Area Life Cycle model. By contrast, if destinations interact and the price sensitivity of tourists is low enough to offset the economies of scale that induce firms to agglomerate, the sharing of tourism between the two destinations is stable. Otherwise tourism tends to agglomerate in one destination. Tourism policies interfere with the agglomeration and dispersion forces and could induce tourist relocation. We calibrate the model with real data before and after the restrictions in force during the pandemic in 2021 and those derived from the war in Ukraine.

Keywords
New Economic Geography, Tourism Area Life cycle (TALC), Footloose capital model, Tourism with mobility restrictions and capacity limits

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Introduction

The geographical distribution of tourism across the world is not even. Tourism occupation rates at very similar destinations can be very different, as observed, for example, at Mediterranean coast destinations. Tourist areas face agglomeration and dispersion forces, the relative importance of which leads endogenously to a specific distribution of tourism. Understanding how these forces work is essential in estimating the consequences of specific policy measures. This is the purpose of the model with two competing destinations proposed in this paper, where the traditional forces of New Economic Geography (NEG) models drive both tourist flows and relocation of firms.

This paper presents a model where tourists demand tourism services (flights, hotel rooms, restaurant meals, tour operators), tourist attractions and local services (private apartments, museums, cultural tours, sport and adventure activities, local craftwork, hairdressing) plus environmental and intangible goods (beaches, mountains, good weather, culture, friendly local people, security). Tourists have to travel to a tourist destination to consume these goods and services, and firms must be at a destination to produce them. An increase in the number of tourists at a destination increases its value for the tourism industry, attracting more firms (market size effect). A higher number of firms reduces the price index, which increases the attractiveness of the destination for future tourists (price index effect). In contrast to these agglomeration processes, increased visitor numbers lead to increases in local prices (congestion effect) and increased number of firms lead to reductions in capital rewards (competition effect), and this fosters the dispersion of tourism. Our aim is to determine the conditions under which some forces overcome others and which results in a long-run geographic distribution of tourism. Policy measures affect these processes, and we studied the consequences of those that limit the capacity of a destination or those that change mobility patterns. We carry out an empirical study focusing on those measures applied during the pandemic in 2020 and the current limitations on tourism due to the war in Ukraine.

The evolution of tourism is a key research area in tourism economics. The Tourism Area Life Cycle (TALC) theory (Butler, 1980) is one of the most widely accepted tools for explaining the evolution of a tourist destination in a purely theoretical framework. This theory argues for the existence of an S-shaped life cycle in the development of destinations with six key stages characterised by different growth rhythms. However, its empirical support is ambiguous. One of the main drawbacks to its empirical validation is that real tourist destinations cannot be isolated as they can be in a theoretical model. Destinations are strongly interconnected. The outbreak of the "Arab Spring" protests, which led to a significant decline in tourism in Tunisia and Morocco, increased the number of tourists in Spain (Albaladejo et al., 2020). The earthquake that hit the Umbria Region of Central Italy on September 26, 1997 reduced arrivals in the Assisi district to less than 50% of the figure for the previous year (Mazzocchi and Montini, 2001). Tourists inevitable flew

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elsewhere. These relocations of tourism often have long-lasting consequences. A case in point is what happened after the tsunami in Thailand in 2004: the resulting decrease in tourism and reduction in hotel occupancy rates there still had not been recouped even years after (Tang et al. 2019). Tourists relocated to other destinations where agglomeration economies retained them, preventing a quick recovery. The concepts and tools of NEG literature can help the TALC theory to deal with the interaction between competing destinations. NEG theory identifies the agglomeration and dispersion forces that operate in a multi-regional economy and how political measures intervene and determine the long-run distribution of economic resources among different regions.

Tourists, tourism firms and local industry interact in our ”two competing destinations” model. We assume an increasing-returns tourism sector that can be located at either destination. That sector needs labour and capital to produce tourism services. Physical capital can be used at one destination while its owner spends the returns in his/her home region. Thus, when there is pressure to concentrate tourism services at one destination, physical capital will move to that destination, but its returns will be repatriated to the owners' home regions. Each destination also produces a homogeneous non-tradable good which is consumed along with tourism services. Technology in the homogeneous goods sector is kept as simple as possible. Producing the homogeneous good requires immobile local labour and capital (local shopkeepers, tour guides, museum staff, cultural heritage) with a constant returns technology. We find that economies of scale in the tourism industry and the price elasticity of the utility for tourists work in favour of the agglomeration of tourism. The basin of attraction of agglomeration equilibria grows with environmental and cultural beauty and the size of the local industry and decreases as the price of tourism services rises. If economies of scale or the price sensitivity of tourists decrease, tourism tends to be distributed between the two regions. In that case, the share of tourism is higher in the nicer or larger region or in the region with the lower prices. The transition from agglomeration to dispersion is abrupt only if the two destinations are identical. In more realistic cases the transition is smooth though it becomes steeper the higher the economies of scale are.

Tourism can have negative effects on the environment and on the well-being of residents. In these cases the authorities may impose limitations on tourist arrivals to avoid overtourism. In other cases, the construction of transport infrastructures or the opening of new airlines may lead some tourists to stop going to their traditional vacation destinations and decide to travel to other regions. The current Covid-19 pandemic has forced hitherto unimaginable extreme measures to be taken in tourism and mobility. Some countries veto tourists from specific origins or those who do not have a Covid-19 vaccination passport. Others discourage their citizens from traveling to destinations with a high Covid risk. Capacity constraints and curfews are imposed, with different levels of strictness at different destinations. The satisfaction of tourists and the profits of firms are affected by these measures, and both groups could have incentives to switch to less severe destinations or to safer places[†]. Another important event affecting tourism flows is the war in Ukraine, which hampers Russian tourism in many countries.[‡] With these exogenous shocks, the current situation has become unstable and tourism tends to shift towards a new equilibrium. We discuss the effects of some tourism policies and external shocks like these in our model.

The rest of the paper is organised as follows. Section positions our model with regard to the TALC and NEG theories and explains our contribution. Section presents the baseline model of two competing destinations, establishing the economic micro-foundations, analysing the short-run equilibrium and the dynamics that arise and also looking at the long run equilibria and their stability. The agglomeration and dispersion forces that arise are also identified. Section draws on the effects of capacity limits and mobility changes in our model. These measures interfere in the evolution of tourism, cause instability and give rise to new equilibria. As in economics it is not possible to perform controlled experiments as in other branches of knowledge, the occurrence of shocks such as a pandemic or the recent war in Europe are invaluable situations for testing the theoretical models. Inspired by the measures adopted in the wake of recent events, Section tests our model with the empirical evidence. Section concludes.

Related literature and our contribution

TALC is one of the most widely used theories of the evolution of tourism at a destination. At its core is the *word of mouth effect,* by which a visitor might induce a potential tourist to visit the destination (Lundorpt and Wanhill (2001), Paphathedorus (2004)). Some empirical studies, however, challenge the theory (Ivars i Baidal et al. (2013), Albaladejo et al. (2020)) and highlight the need to introduce new elements. Economic factors such as the organization of the industry, the market structure (Debbage, 1990) and agglomeration externalities need to be taken into account. Being near other firms promotes a more efficient use of knowledge and enables constructive interactions between firms to be built up (Jacobs, 1969). The TALC theory can be enriched with these concepts from NEG literature (Krugman, 1991). As we prove in this paper, agglomeration economies build interconnections between tourist destinations. They are no longer isolated. Any change in one destination, e.g. an increase or decrease in the supply of services and goods, and any political measure or restriction on the number of tourist arrivals may affect, not only the evolution of that specific destination, but also that of other competing destinations.

On the supply side, our model has some similarities with the Footloose Capital model in NEG literature (Martin and Rogers (1995), Baldwin et al. (2003)). But for the sake of simplicity, and because we seek to study interaction between tourist destinations, it is assumed that capitalists spend their

[†]There were cancellations en masse in Spain by UK tourists because of vaccination requirements for children (Hosteltur, 10th February 2022). https://www.hosteltur.com/149755_cancelaciones-en-masa-a-espana-por-las-reglas-anticovid-para-ninos.html

[‡]"Global tourism industry feels the pinch of Ukraine war's fallout" (Arab News, April 2022) https://www.arabnews.com/node/2066631/world

rents in a third country (the rest of the world), the same as the home country of tourists.

On the demand side, tourists in our model play a similar role to peasants in the agricultural sector in conventional NEG models. The higher the average number of tourists per firm at a destination, the more attractive that region is to tourism firms (*market size effect*). However, unlike peasants, tourists can freely move between the two regions and they face a trade-off between moving to the larger tourism market, where the price index of tourism services is lower (*price index effect*), and remaining where competition for local homogeneous goods is lower (*congestion effect*). This last effect, which is a price effect for local goods and services, reflects the fact that those prices become higher when the number of tourists in a destination increases, which favours convergence between regions while the market size and price index effects favour divergence. This is not the only dispersion effect in the model. Note that, as the number of firms in a destination increases, given a specific number of tourists, capital rewards decrease, which discourages the investment in the destination (*competition effect*).

Like workers in the Core-periphery model by Krugman (1991), tourists are consumers of industry products, but by contrast, do not contribute to their production. In the conventional Core-periphery model workers, consumers and firms move together between regions as a sole agent, while in the Footloose Capital model firms move but consumers/workers stay put. In our geographical tourism model tourists move between regions just as workers in the Core-periphery model do, and tourism firms move as capital does in the Footloose Capital model. We focus on tourism goods and services, so workers are not consumers in our model. Labour and capital in the homogeneous goods sector (local shopkeepers, museums staff, etc.) are immobile, while workers at tourism firms (hotel managers, waiters, etc.) move as freely between regions as capital does. Despite the similarities, our model does not fit into NEG literature. Our industrial products are not tradable between regions and trade costs play no role. Even so, the location of tourism firms matters. Note that tourists must travel to a destination to consume tourism and local goods and it is tourism that turns goods that cannot be traded internationally in any other way into tradable goods. Differences between regions in tourism occupation drive the relocation of firms.

Some of the tourism policies implemented by regional authorities directly affect firms' profits, while others affect the satisfaction of tourists or have mixed effects. For this reason, pure Footloose Capital or Core-periphery models are not suitable ways to represent competition for tourism between destinations. However, their tools from industrial organisation theory can help formalise the interregional mobility of tourism.

Unfortunately, the literature that examines spatial interactions in the tourism industry is limited. Inspired by standard NEG models (Dixit and Stiglitz, 1977; Fujita et al., 1999; Krugman, 1991), Yang (2014) builds up an econometric spatial model to analyse the links between market potential, industry density and company revenue in China. The study provides evidence that the market potential and agglomeration density of tourism are statistically significant and quantitatively important in explaining the revenue of tourism firms. Zhang (2017) concentrates on the study of interregional tourism development with capital accumulation. Interregional flows of tourism are taken into account in a neoclassical growth model that introduces endogenous tourism. Nevertheless, as Coles (2008) complains, the study of the geography of tourism lacks strong theoretical foundations and sophisticated models.

We seek to contribute to this literature with a geographical model which is in line with the tradition of tourism development literature. Our model broadens the well-known TALC theory, with competing destinations being taken into account. We prove that if economies of scale in the tourism industry become constant and tourists do not appreciate the local good, the interaction between destinations vanishes and a logistical growth of tourism at each destination arises, as predicted by the conventional TALC theory. However, if there are economies of scale and a share of expenditure is devoted to purchasing the local good, the evolution of tourism at each destination interact. Our model brings this interaction into the TALC model. It simultaneously includes time and geography, giving the TALC theory a spatial component that enables tourism flows between destinations to be studied.

The baseline model

We assume two competing tourist destinations $j = 1, 2$ and an increasing-returns tourism sector[§] that can be located at either destination. This sector produces differentiated services under monopolistic competition. Each destination also produces a homogeneous non-tradable good H_j which is consumed along with tourism services in a perfect competitive market. The production of each differentiated tourism service needs mobile labour and capital. For example, in hotel industry, we can see that both capital and labour can adjust to demand by moving between destinations. We assume that their returns are spent in their region of origin, a third country from which tourists originate. Producing the homogeneous good requires local inputs, such as immobile labour and destination specific capital, with a constant returns technology. The homogeneous good is consumed by tourists along with differentiated tourism services and environmental and cultural endowments. Tourism services encompass very different goods and services (transport, accommodation, catering, tourism attractions) and it is difficult to make a clear distinction between the two types of services in reality. In the accommodation industry, for example, we have both, hotel bedspaces, which fall into our category of services produced with mobile inputs, and private apartments owned by residents, which can be considered as homogeneous goods produced with local immobile resources. By contrast, local tourism attractions, such as visits to museums, are clearly produced with immobile labour (museum staff) and local endowment (cultural heritage).

[§]The measurement of economies of scale in the tourism industry has not received enough attention from economists. However, Shi and Smyth (2012) and Weng and Wang (2004) find evidence of increasing returns in several tourism services.

Tourists

Tourists view destinations as bundles of different public and private goods and services (Sinclair and Stabler, 1997). Services related to accommodation and accessibility at the destination (hotels, transport, restaurants, tour operators, travel agencies, etc.), attractions and local services (museums, cultural tours, sport and adventure activities, local craftwork, hairdressing, etc) and many intangible goods (such as good weather, atmosphere, ambiance, security, culture and friendly local people) are the components of the tourist experience. Thus, the utility for a representative tourist in destination j $(j = 1, 2)$ can be defined as[¶]

$$U_j = A_j C_j^{\beta} H_j^{1-\beta} \text{ with } C_j = \left(\sum_{i=1}^{n_j} c_{ij}^{1-\frac{1}{\sigma}} \right)^{\frac{1}{(1-\frac{1}{\sigma})}}, \quad (1)$$

with $\sigma > 1, \beta \in (0, 1), j = 1, 2$.Where C_j is consumption of the composite tourism services c_{ij} (with $i = 1, 2...n_j$), H_j is the consumption of the local homogeneous good and A_j, is the intangible natural and cultural beauty. The value $\sigma > 1$ is the elasticity of substitution between the products, which is higher than 1 because tourists like variety.[‖] Tourists choose how much they consume of each good c_{ij}, $i = 1, 2...n_j$, and H_j in such a way as to maximise their utility taking the budget constraint into account

$$\sum_{i=1}^{n_j} p_{ij} c_{ij} + p_{H_j} H_j = E \quad (2)$$

where E is the budget for spending on tourism. As understood by Eugenio-Martín (2003), tourists face a multi-stage decision problem in which the decisions about destinations and budget are taken at different stages. Following this idea, we start by assuming that the budget for tourism has already been decided upon. Once this decision has been made tourists must then decide where to travel so as to maximise utility. Optimality conditions give the following demand functions

$$c_{ij} = \beta \frac{p_{ij}^{-\sigma} E}{P_j^{1-\sigma}} \quad (3)$$

$$H_j = (1-\beta) \frac{E}{p_{H_j}} \quad (4)$$

with the price index

$$P_j = \left(\sum_{i=1}^{n_j} p_{ij}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$$

Tourism industry vs domestic production

Each destination produces a variety of differentiated tourism services x_{ij}, $i = 1, 2, ...n_j$ with physical capital and labour (mobile factors). Capital is only employed in meeting the fixed costs of tourism firms while all variable costs involve labour. Assume that there are N firms dedicated to providing tourist services, part of them allocated to each alternative $j = 1, 2$. Those firms are created with capital. The proportion of firms at a destination represents the participation of capital in that destination.

As in the Footloose Capital model, the implied cost function of a firm, where it is assumed that only one unit of capital is necessary to produce tourism services, is

$$\pi_j + w_j a_j x_{ij} \quad (5)$$

where π_j and w_j are the returns on capital and labour, x_{ij} is the firm-level output and a_j is the variable unit input requirement, which could be different at each destination $j = 1, 2$. We assume Dixit-Stiglitz monopolistic competition, which means that tourism service providers choose the price that maximises profits, taking individual demand (3) as given and total demand as $c_{ij} T_j$, where T_j is the number of tourists at destination j. This implies that

$$p_j \equiv p_{ij} = \frac{w_j a_j}{1 - 1/\sigma} \text{ for all } i \text{ and } j = 1, 2 \quad (6)$$

Therefore, price indices are given by

$$P_j = \frac{w_j a_j}{(1 - 1/\sigma)\, n_j^{1/(\sigma-1)}} = \frac{p_j}{n_j^{1/(\sigma-1)}}, j = 1, 2 \quad (7)$$

thus

$$c_j = c_{ij} = \beta \frac{1 - 1/\sigma}{n_j w_j a_j} E = \frac{\beta E}{p_j n_j}, \quad j = 1, 2 \quad (8)$$

Because there is free entry in the tourism services sector, a firm's profit must equal zero. Using this condition and (6) it is obtained that

$$\pi_j = p_j c_j T_j / \sigma \text{ for } j = 1, 2 \quad (9)$$

It should be noted that although σ is a parameter of tastes rather than technology, it can be interpreted as an inverse index of economies of scale. Note that the ratio between marginal cost of production $w_j a_j$ (from (5)) and average cost in a zero-profit equilibrium is $(\sigma - 1)/\sigma$. This ratio takes a value of less than 1, which means that total cost increases proportionally less than output. This is turn means that the industry exhibits increasing returns. Lower values of $(\sigma - 1)/\sigma$, i.e. lower values of σ, mean greater economies of scale.

Tourists spend their whole budget E on tourism services and on consuming the homogeneous good. Given the Cobb-Douglass structure of utility function (1), tourists spend a share of their budget βE on tourism services, so using demands (8) the following equilibrium expressions can be written for π_1 and π_2,

$$\pi_1 = \frac{\beta}{\sigma} \frac{E}{n_1} T_1, \quad \pi_2 = \frac{\beta}{\sigma} \frac{E}{n_2} T_2 \quad (10)$$

More firms at a destination means lower capital returns in that destination (*competition effect*) and, conversely, more tourists means higher capital returns (*market size effect*).

[¶]This utility function is a special case of the Dixit-Stiglitz (1977) model. We follow Laurence and Spiller (1983) in introducing a homogeneous commodity.

[‖]Consumers like variety (Krugman, 1991). However, tourism literature lacks empirical studies on the elasticity of substitution between tourism goods. We assume that tourists like variety as consumers do in general economic theory.

Note that if tourism occupation at both destinations is the same, $T_1/n_1 = T_2/n_2$, then $\pi_1 = \pi_2$ and there are no incentives for capital to migrate from one destination to the other. Differences in the level of tourism occupation can boost the arrival of tourism firms at a destination and the exit of firms from the other.

Tourists spend a share $1-\beta$ of their budget, i.e. $(1-\beta)E$, on the local homogeneous good, which is produced with a constant returns technology in a perfect competitive market. Taking (4) into account and the fact that one unit of immobile local input (local labour and capital) produces one unit of the homogeneous good, i.e. $H_jT_j = L_{H_j}$, then

$$p_{H_j} = (1-\beta)E\frac{T_j}{L_{H_j}} \tag{11}$$

where L_{H_j} is the local input in the homogeneous sector. Note that, unlike the price of tourism services, (6), p_{H_j} increases with the number of tourists. In other words, tourism raises the price of the local good p_{H_j} and returns in this sector, which can differ from returns in the homogeneous sector of the other region, given that the input in the local goods industry L_{H_j} does not move between regions.

Labour in the tourism sector can move freely between regions, which means that $w_1 = w_2$. We take this wage as the numeraire$w_1 = w_2 = 1$.

Indirect utility

Tourists' satisfaction is measured by utility (1), but when they decide where to travel tourists take into account their budget, the cost of tourism services and the price of the local good. Thus, from (1), taking into account (2), (3) and (4), the following is obtained:

$$V_j = \beta^\beta(1-\beta)^{1-\beta}A_j\frac{E}{P_j^\beta p_{H_j}^{1-\beta}}, \qquad j=1,2 \tag{12}$$

This is called the indirect utility and is what really drives the decisions of tourists. Having more firms at destination j reduces the price index P_j and increases the indirect utility (*price index effect*). To check this, assume that $A_1 = A_2$, $p_1 = p_2$ and $L_{H_1} = L_{H_2}$. It can be seen that if $T_1 = T_2$ and $n_1 = n_2$ then $V_1 = V_2$. If the number of tourists is then shifted to region 1 (with the number of firms remaining the same) however, the relative utility V_1/V_2 decreases. This is because a higher number of tourists increases demand for the local good and thus raises its price, reducing indirect utility (*congestion effect*). Note that market size has a negative effect on indirect utility, because of tourism congestion, but a positive one on capital returns.

As we move from short-run to long-run equilibrium, the higher capital returns in the more touristic region will induce more firms to move there. Then a third consideration enters the picture: the region with more firms will have a lower price index of tourist goods (equation 7). There is a trade-off between traveling to the more popular destination and visiting the region where competition for the local homogeneous good is lower.

Tourism Dynamics

Growth in the number of tourists is positively affected by growth in international tourism around the world. However, given that there are competing destinations, tourists and tourism firms can switch from one destination to another, modifying the induced growth trend. We assume that the increment in the number of tourists visiting country $j = 1,2$ and the increment in the number tourist-related firms per unit of time t (years, months) in those countries can be represented by the following differential equation systems,[**]

$$\dot{T}_1 = \gamma T_1 + T_{1/2} - T_{2/1}, \;\; \dot{n}_1 = \gamma n_1 + n_{1/2} - n_{2/1} \tag{13}$$

$$\dot{T}_2 = \gamma T_2 - T_{1/2} + T_{2/1}, \;\; \dot{n}_2 = \gamma n_2 - n_{1/2} + n_{2/1} \tag{14}$$

where T_j is the number of tourists at a destination j at time t, n_j is the number of firms at j at time t, γ is the growth rate in international tourism [††], $T_{i/j}$ is the number of tourists who, having visited country j, travel to country i at time t and $n_{i/j}$ is the number of firms which switch their location from country j to country i at time t.

It is well established in tourism economics that the *word of mouth effect* drives willingness to visit a destination (Litvin et al., 2018; Verma and Yadav, 2021). That is, one visitor can induce other to visit the same destination. On the other hand, firms take agglomeration externalities into account in making location decisions. Being near other firms is conducive to a more efficient use of knowledge and helps build up constructive interactions between firms (Jacobs, 1969). Once a firm is settled at a destination, informational spillover can call other firms to settle there too. According to NEG literature (Krugman, 1991), agglomeration economies generate a self-reinforcing process and attract other tourism firms to locate in a region, which explains the industrial clusters observed in economic geography and, of course, in the tourism industry. Therefore, we assume that

$$T_{i/j} = b_{i/j}T_i \qquad n_{i/j} = q_{i/j}n_i$$

where $b_{i/j}$ is the probability that a tourist at destination i will convince a tourist at destination j to visit country i at time t; $q_{i/j}$ is the probability that a firm at destination i attracts a firm from destination j at time t. $b_{i/j}$ depends on the indirect utility at destination i and the share of tourists at j at time t. $q_{i/j}$ depends on capital returns at destination i and the share of firms in destination j at time t. Therefore, we assume that

$$b_{i/j} = V_i\frac{T_j}{T} \qquad q_{i/j} = \pi_i\frac{n_j}{N} \tag{15}$$

Replacing (15) in (13)-(14) the following differential equations system is obtained:

$$\dot{T}_1 = \gamma T_1 + (V_1\text{-}V_2)\frac{T_1T_2}{T}, \;\; \dot{n}_1 = \gamma n_1 + (\pi_1\text{-}\pi_2)\frac{n_1n_2}{N} \tag{16}$$

$$\dot{T}_2 = \gamma T_2 + (V_2\text{-}V_1)\frac{T_1T_2}{T}, \;\; \dot{n}_2 = \gamma n_2 + (\pi_2\text{-}\pi_1)\frac{n_1n_2}{N} \tag{17}$$

Note that indirect utility is affected by price indices P_j and price p_{H_j}. The price index P_j depends on the number of firms at destination j (equation (7)) and those firms are mobile between regions. Consequently, $\dot{T}_1$ and $\dot{T}_2$ are interconnected and cannot be reduced to two independent differential equations. The same goes for $\dot{n}_1$ and $\dot{n}_2$.

[**] All variables are time-dependent in our model and, as there was no confusion, we avoided adding the time argument to them.

[††] We assume, with no loss of generality, that the number of tourists and the number of firms grow at the same rate γ. The same conclusions would be obtained with different growth rates.

What if only environmental and cultural beauty mattered?

To validate the consistency of our model with main stream tourism economy literature, in this section we assume that if tourists take into account only environmental or cultural beauty A_i in choosing one of the two destinations and do not care about the variety of tourism services ($\sigma \to 1$) and the local homogeneous good ($\beta \to 1$), then the model predicts an S-shaped trend in the number of tourists for each destination, as the Tourism Area Life Cycle theory does.

Note that if σ decreases to 1, tourism service variety is not relevant and any tourism service can be substituted by the same quantity of another without reducing the satisfaction of tourists. If that case, a single tourism good is produced and no firm has monopoly power. The tourism market should work in perfect competition with constant returns to scale. Consequently, the price of the single tourism service is equal to the marginal costs. If β increases to 1, tourists are only interested in tourism services and consumption of the local homogeneous good does not contribute to their satisfaction. Thus, $V_j = \bar{V}_j \equiv EA_j/a_j$ is constant and the interaction between the two destinations disappears. Therefore

$$\dot{T}_j = \gamma T_j + \left(\bar{V}_j - \bar{V}_i\right) \frac{T_j T_i}{T} \text{ with } j,i = 1,2$$

and taking into account $T = T_1 + T_2$ the following emerges:

$$\dot{T}_j = \gamma_{j/i} T_j \left(1 - \frac{T_j}{\delta_{j/i} T}\right), \qquad j,i = 1,2. \tag{18}$$

where $\gamma_{j/i} = \gamma + \bar{V}_j - \bar{V}_i$ and $\delta_{j/i} = \frac{\gamma}{\bar{V}_j - \bar{V}_i} + 1$ are constants. Note that (18) is the logistic growth differential equation used by Lundorp and Wanhill (2001) to represent the Tourism Area Life Cycle theory (Butler, 1980).

According to this result, if only natural beauty matters, the interaction between the two destinations disappears and our model converges to the TALC theory. However, aside from the natural beauty of a destination tourists do also take into account the variety of services and goods that can be consumed along with natural or cultural attractions. The consumption of these tourism services and goods implies spending and tourists are constrained by a budget (equation (2)), which is why they compare the indirect utility levels at the two destinations.

Long-run equilibria

World tourism and the tourism industry grow at a rate γ, which may or may not be constant. The value of γ changes with the economic cycle and may be affected by economic and sociological variables. However, in this section we look at the long run shares of tourism in regions 1 and 2. Let $s_T = T_1/T$ and $s_N = n_1/N$ be the shares of tourists and tourism firms at destination 1. Thus, from (16)-(17)[‡‡]

$$\begin{aligned} \dot{s}_T &= s_T(1 - s_T)(V_1 - V_2) \quad (19) \\ \dot{s_N} &= s_N\left(1 - s_N\right)\left(\pi_1 - \pi_2\right) \quad (20) \end{aligned}$$

There are two agglomeration equilibria for the differential equation system (19)-(20)

$$s_N = s_T = 0 \text{ and } s_N = s_T = 1 \tag{21}$$

and an interior equilibrium which is

$$s_N^* = s_T^* = s^* = \frac{1}{\Omega^{(\sigma-1)/(1-\sigma(1-\beta))} + 1} \tag{22}$$

with $\Omega = AL_H^{(1-\beta)}/p^\beta$, $A = A_1/A_2$, $p = p_1/p_2$ and $L_H = L_{H_1}/L_{H_2}$. Given that wages in the tourism industry are the same in both regions, a value of p other than 1 means differences in labour productivity a_j. The ratio L_H can be seen as a measure of the relative sizes of the two destinations. The value of Ω represents the attractiveness of region 1 relative to region 2. If the two destinations are identical ($A = L_H = p = 1$) the interior equilibrium implies an equal distribution of market and capital, that is, $s_T^* = s_N^* = 1/2$. However, when any of these elements varies in favour of one destination (greater natural beauty, greater size or lower price) the interior equilibrium will not be symmetric. This means an unequal distribution of the tourism market and of capital. The maximum divergence between regions is at the agglomeration equilibria.

Now we consider whether a situation in which tourists and firms are not fully concentrated in one region is stable. Assume that the system is at the interior equilibrium $s_T = s_N = s^*$. Starting from that situation, is it possible for an individual firm in region 2 to relocate and increase returns in region 1? If not, then the equilibrium situation is stable; if so, it is not. The decision to relocate would be made if the hypothetical runaway firm were able to attract more than the average number of tourists per firm in region 1, that is $dT_1/dn_1 \geq T_1/n_1$, otherwise returns in region 1 would decrease. To that end, tourists would have to be compensated with a higher indirect utility, that is

$$\frac{d(V_1 - V_2)}{dn_1} = \frac{\partial(V_1 - V_2)}{\partial T_1}\frac{dT_1}{dn_1} + \frac{\partial(V_1 - V_2)}{\partial n_1} > 0 \tag{23}$$

The boundary of parameter values for which firms are indifferent between staying in region 2 and moving to region 1 is obtained when $dT_1/dn_1 = T_1/n_1$, that is $dT_1/dn_1 = (s_T T)/(s_N N) = T/N$ at the equilibrium, and then

$$\begin{aligned} \frac{d(V_1 - V_2)}{dn_1} &= \left(-\frac{1-\beta}{T}\frac{dT_1}{dn_1} + \frac{\beta}{\sigma - 1}\frac{1}{N}\right)\frac{\Delta^*}{s^*(1 - s^*)} \\ &= -\frac{\Delta^*}{n_1(1 - s^*)}\left(1 - \frac{\beta}{1 - 1/\sigma}\right) = 0 \end{aligned}$$

with $\Delta^* > 0$ defined in (34) in Appendix A. If parameters lie on one side of this boundary, $\beta < 1 - 1/\sigma$, hypothetical tourists attracted by the runaway firm would obtain less satisfaction than if they remain in region 2. Consequently, the firm will not relocate and the interior equilibrium is stable. By contrast, if $\beta > 1 - 1/\sigma$, the equilibrium is not

[‡‡]Note that,

$$\begin{aligned} \frac{\dot{s}_T}{s_T} &= \frac{\dot{T}_1}{T_1} - \frac{\dot{T}}{T} = (V_1 - V_2)\frac{T - T_1}{T} \text{ and} \\ \frac{\dot{s}_N}{s_N} &= \frac{\dot{n}_1}{n_1} - \frac{\dot{N}}{N} = (\pi_1 - \pi_2)\frac{N - N_1}{N} \end{aligned}$$

Calculations are shown in Appendix A.

sustainable and tourists and tourism firms concentrate in one region. That is, the larger the share of expenditure on tourism goods, β, the larger the tourism market is and the stronger the market size effect, which works in favour of agglomeration. Equally, large economies of scale (low values of $1 - 1/\sigma$) favour tourism agglomeration. Tourism dispersion between the two regions appears if there are smaller economies of scale in the tourism industry and smaller shares of expenditure on tourism services. Thus, the interior equilibrium (22) is stable and the agglomeration equilibria are unstable if and only if

$$\beta < 1 - 1/\sigma \qquad (24)$$

This condition establishes a link between the speed of movement of tourists and firms. Note that β also measures the sensitivity of indirect utility (12) to price index variations. The price index of tourism services (7) changes with the number of firms. Therefore, a 1% rise in the number of firms in a region does not increase indirect utility by 1% but by $\beta/(\sigma-1)$%. For the interior equilibrium to be stable tourists' sensitivity to the movements of firms $\beta/(\sigma-1)$ needs to be sufficiently lower than in the linear case to offset the economies of scale that induce firms to agglomerate, that is

$$1 - \frac{\beta}{\sigma - 1} > 1 - \frac{1}{\sigma}$$

If the economies of scale are very high (low values of $1 - 1/\sigma$) the price sensitivity of tourists should be low enough to offset the tendency of firms to agglomerate.

To simplify presentation we define $\tau = \sigma(1-\beta)$. Note that τ is higher than 1 if and only if condition (24) is satisfied. Low values of τ mean high economies of scale and high price index elasticity of indirect utility. For identical destinations ($A = L_H = p = 1$), the diagram in Figure 1 represents the steady state values of s^* for each value of τ. The continuous line means stable equilibria and the discontinuous line means instability.

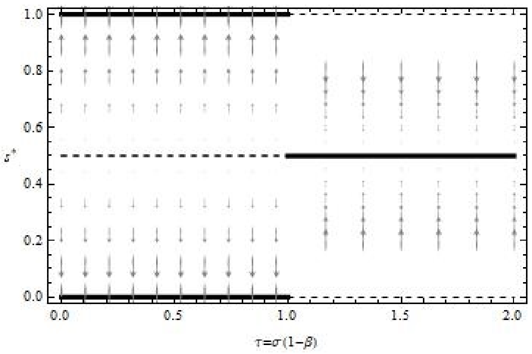


Figure 1. $s_T = s_N = 0$ and $s_T = s_N = 1$ are locally stable if and only if $\tau < 1$. If $\tau > 1$ the interior symmetric equilibrium is globally stable.

Note that $\tau = 1$ is a break point, i.e. around it small changes in economies of scale in the tourism industry or variations in the preferences of tourists (i.e. changes in σ or in β) can result in big changes in the long run distribution of tourism. If τ increases to slightly above 1, tourism will change from being agglomerated in one region ($s_T = s_N = 0$ or $s_T = s_N = 1$) to being evenly distributed across the two regions, $s_T = s_N = 1/2$. High economies of scale in the tourism sector and a high price elasticity of indirect utility can take τ below the threshold 1, which drives tourism agglomeration in one of the two regions. This could be the situation in the years prior to the pandemic in 2020, when overtourism was a great concern among tourism economists. In regard to spending by foreign tourists, the Spanish Statistics Institute (INE) states that the value of β has dropped from 0.71 before the pandemic to $0,68$ in the last few years, which could work against overtourism, favouring the convergence of tourism rates at different destinations. In this theoretically symmetric case, if $\tau < 1$ the basins of attraction of the two agglomeration equilibria are identical, so the likelihood of agglomeration in region 1 is the same as in region 2.

In more realistic scenarios, with differences in beauty, prices and/or sizes, the basins of attraction differ in size, as shown in Figure 2. Figure 2 (a) shows that if destination 1 is nicer or larger than destination 2 ($A > 1$ or $L_H > 1$) then the basin of attraction of region 1 agglomeration equilibria is larger than region 2, provided that $\tau < 1$. If $\tau > 1$, the interior stable equilibria have a higher share of tourism in region 1 than in region 2. Figure 2 (b) shows that, for the same level of beauty and size, if prices of tourism services are higher in region 1 than in region 2, the conclusions are the opposite. That is, if $\tau < 1$ the basin of attraction of these equilibria grows bigger with beauty and size of the local industry and smaller with the price of tourism services. If $\tau > 1$ tourism is not fully agglomerated in one of the regions but the share of tourism also increases with beauty and the size of the local industry and decreases with the price of tourism services. As τ increases tourism shares in the two regions become more similar. The abrupt jump in Figure 1 when τ exceeds 1 is not found in Figures 2 (a) and (b). The transition is smooth but Figures 2 reveal that higher economies of scale (lower values of σ) make the transition steeper if τ increases.

Economies of scale in the tourism industry are hard to measure because there are many industries related to

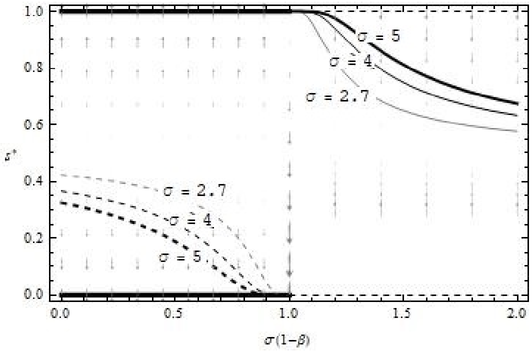
In Appendix A we provide a technical proof using differential calculus techniques.

The Spanish Statistics Institute (INE) publishes an itemised survey on spending by foreign tourists (spending on transport, accommodation, restaurants, package tourism and other goods and services). The accurate calculation of parameter β would need a rigorous study beyond the scope of the current paper. We are aware that all these items are a mixture of goods made of immobile and mobile inputs. We concluded that spending on "other goods and services" contains spending on museum visits, cultural activities, local attractions, etc which more clearly seem to be produced with local immobile inputs. Being aware of this limitation with the data, we calculated β by dividing the spending on tourism services (the first four items) by total spending, giving a figure of 0.71 in the years 2017 to 2019 and 0.68 in 2020 and 2021.

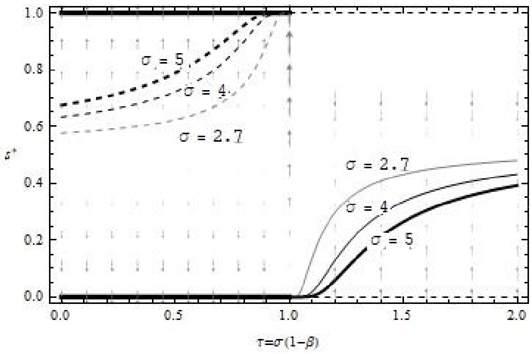
The basin of attraction of an equilibrium is the set of initial conditions from which the system will converge towards the equilibrium. In Figure 1, the set of initial conditions for s_T that drive to equilibrium is represented via arrows.

For a given value of $\sigma > 1$, if $\sigma(1-\beta)$ increases (that is, β decreases) then s^* decreases if $A > 1$ or $L_H > 1$, and s^* increases if $p > 1$,

Note that the transition is smooth for any value of the parameters given that, by (22), $\lim_{\sigma(1-\beta)\to 1^-} s^* = 0$ if $\Omega > 1$ ($= 1$ if $\Omega < 1$) and $\lim_{\sigma(1-\beta)\to 1^+} s^* = 1$ if $\Omega > 1$ ($= 0$ if $\Omega < 1$)



(a) $A > 1$ or $L_H > 1, p = 1$



(b) $A = L_H = 1$ and $p > 1$

Figure 2. Stability of the long run equilibria in the baseline model

tourism. Chief among them are accommodation, transport, retail trade and recreational services. Shi and Smyth (2012) find evidence in the Australian tourism industry of increasing returns in transport, retail trade and recreational services at industry level. However, in accommodation, which comprises a bundle of different types of lodgings (hotels, motels, private apartments) they find constant returns to scale at industry level. Looking at the hotel industry, Weng and Wang (2004) find that increasing returns to scale are significantly present in Taiwan. Shi and Smyth (2012) find that economies of scale vary between 0.2 and 0.92 depending on the type of service and its location. This leads to a wide range of values of σ between 1.25 and 12.5, among which the values used in Figure 2 are found.

Tourism policies

Our baseline model assumes that agents (tourists and capitalists) take their decisions in a decentralized setting. The equilibrium is the result of the interaction of individual actions. A regional authority could implement policies that steer the destination in a certain direction. For example, the regional authority could force capacity restrictions to avoid overtourism and environmental degradation. The creation of a new transport route could induce mobility changes that affect tourist arrivals at a destination. The recent measures to control the pandemic and the consequences of the war in Ukraine had led to instability and new equilibria can appear. The relocation of tourists induced by these measures can be studied in our model.

Changes in the mobility patterns can be analysed as follows. Consider that destination 1 hosts ϕT_1 tourists from the rest of the world at time t and $(1-\phi)T_1$ from an origin affected by policies discouraging travel to destination 1 in the future (i.e. tourists from a country that prohibits/discourages travel to destination 1 because of an unstable political situation; or tourists from an origin affected by the closure of a flight route). These $(1-\phi)T_1$ tourists in destination 1 could find it easier to travel to destination 2 in the next period due to the opening of a new transport route. In these scenarios, the indirect utility for tourists who visit country 1 (a share ϕ of the potential number of tourists) is still V_1, but the number of tourists is reduced. Then, capital returns will be reduced to a fraction ϕ at destination 1 and will increase by the same proportion at destination 2, i.e. (10) changes to

$$\frac{\beta}{\sigma}\frac{E}{n_1}\phi T_1 = \phi\pi_1, \text{ in region 1 and} \tag{25}$$

$$\frac{\beta}{\sigma}\frac{E}{n_2}(T_2 + (1-\phi)T_1) = \pi_2 + (1-\phi)\pi_1\frac{s_N}{1-s_N}, \tag{26}$$

in region 2. In this situation, the agglomeration of tourism at destination 1 ($s_T = s_N = 1$) is no longer an equilibrium. The equilibria are $s_T = s_N = 0$, which are stable if (24) is not satisfied. If this condition is met, there is always a stable interior equilibrium with $s_T^* \in (0,1)$ and $s_N^* = \phi s_T^*$ characterized by equation (30) in Appendix A.

By contrast with the interior equilibrium in the baseline model (22), $s_N^* < s_T^* < s^*$ and the symmetric equilibrium is not reachable even if both destinations are equal. Thus, if (24) is satisfied and there are policy measures that induce the relocation of tourists from destination 1 to destination 2, the shares of tourists and tourism firms in region 1 are lower than in the baseline model without constraints (22). Moreover, firms in region 1 will only serve a share ϕ of the potential visitors, but the amount spent by each tourist will remain the same. In such a situation a firm will only remain in this region if the number of tourists per firm T_1/n_1 is higher than the average T/N, despite the reduction in the number of visitors, i.e. $s_T^*/s_N^* > 1$. Otherwise, despite tourists' spending remaining the same, lower tourism occupation will result in a drain of firms from region 1 to region 2.

Another form of intervening in tourism flows is by limiting the capacities at destinations. Tourism development often leads to environmental degradation of destinations and inconvenience for residents. Overtourism is a major concern for destination managers. Capacity constraints on entering natural protected areas and monuments are some of the policies that have been implemented. Likewise, during the pandemic the tourism industry had to meet capacity constraints imposed by the authorities to ensure social distancing. In general, despite being able to produce the services demanded, c_jT_j, the authorities force firms to reduce their capacity in these situations to $\delta_j c_j T_j$ with $\delta_j \in (0,1]$, $j = 1,2$ in order to reduce congestion. Consequently tourists spend a lower share of their budget on tourism services ($\delta_j\beta E < \beta E$) and the tourism market shrinks. The

The differential equations system driving the time evolution of the shares of tourists and firms is presented in Appendix B. The equilibria and their stability are shown in Appendix A.

capital reward of producing $\delta_j c_j T_j$ in region j will be $\delta_j \pi_j$, with $\delta_j \in (0, 1)$ and π_j as defined in (10). Capitalists take into account this measure and decide whether to relocate their capital.

Since the utility function (1) is a Cobb-Douglas function in the composite of tourism services C_j and the homogeneous good H_j, the elasticity of substitution between the two is 1 and consumers can replace their consumption of tourism services by consumption of the homogeneous good. For example, if access to the main monuments in a city is limited, tourism firms in the area will suffer a reduction in arrivals, while local establishments will be more in demand. This was something that we saw during the pandemic, as restaurant meals were replaced by home-made meals made with products bought at a supermarket and the ban on night-time parties gave more time for daytime activities such as shopping, trekking, diving, etc. If the share of budget spent on tourism services falls to $\delta_j \beta E$ then the share spent on the homogeneous local good increases to $(1 - \delta_j \beta)E$, enlarging the market for that good. However, despite this substitution, prices are determined in different markets and tourists' preferences for tourism services are different from their preferences for the homogeneous good. The indirect utility will be affected:

$$V_j(\delta_j) = (\delta_j \beta)^\beta (1 - \delta_j \beta)^{1-\beta} A_j \frac{E}{P_j^\beta p_{H_j}^{1-\beta}} \text{ and } p_{H_j} = (1 - \delta_j \beta) E \frac{T_j}{L_{H_j}}, \; j = 1, 2$$

With these types of measures, there are two agglomeration equilibria, $s_T = s_N = 0$ and $s_T = s_N = 1$, which are stable if (24) is not satisfied. If the condition is met, there will be a stable interior equilibrium with $s_T^* > s_N^*$ if $\delta = \delta_1/\delta_2 < 1$.If (24) is satisfied then the shares of tourists and tourism firms in region 1 are lower than in the baseline model (22). The symmetric equilibrium is not reachable even if the two destinations are equal.

As in the interior equilibrium of the model in the case of mobility restrictions, and contrary to the equilibrium in the baseline model (22), $s_T^* > s_N^*$ if $\delta < 1$. Firms in region 1 are forced to reduce capacity to a greater extent. They will only remain there if the average number of tourists per firm is higher than in region 2. Otherwise, with the same (or lower) tourism occupation but lower spending per tourist, firms will leave the region and move to region 2. Capacity constraints affect, not only capital returns but also the utility for tourists.

Empirical relevance

Controlled experiments are not always possible in economics. Therefore, the occurrence of a shock such as a pandemic or a war, like the recent one in Ukraine, are valuable situations in which to test theoretical models. These events have forced severe tourism policies in many countries for at least two years and even longer in Asian countries.

According to the United Nations World Tourism Organization (UNTWO), in 2020, the restrictions and suspensions affecting tourism and international travel imposed by many countries to prevent the spread of the Covid-19 resulted in a drop of between 60 and 80 percent in world tourism activity. In 2021, with vaccination underway, it was decided to lift some health constraints (elimination of curfews, extension of night-life opening hours). Spain opened its borders to fully vaccinated tourists from around the world in the summer of 2021. However, the region of Catalonia still had high Covid rates and was considered by the United Kingdom and German authorities as a dangerous destination. By contrast, its main competitor, the Balearic Islands, was on the list of Covid safe regions.

According to data from the Tourist Movement on Borders Survey (Frontur, INE), the trend in the proportion of the total number of tourists in the Balearic Islands and Catalonia who visit Catalonia is as shown in Figure 3.

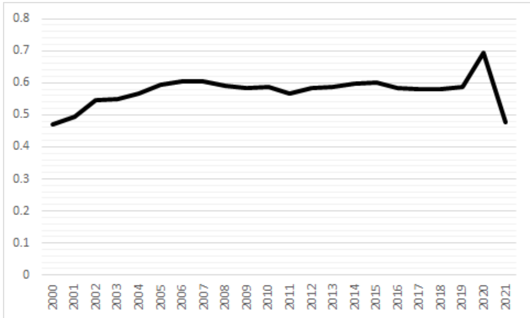


Figure 3. Share of total tourists in the Balearic Islands and Catalonia accounted for by the latter.

From 2002 to 2019, Catalonia accounted for 0.6 of the total for both destinations, revealing it to be a more popular destination for foreign tourists than the Balearic islands in those years. In 2021, just after the UK and German recommendations, tourist numbers in both Catalonia and the Balearic Islands suffered a significant drop (70% in Catalonia and 53% in Balearic Islands on 2019 figures). The Balearic Islands seem to have recovered faster because the proportion of tourists was reversed in its favour with Catalonia accounting for just 0.478 of the total in 2021. Moreover, the percentage of German and British tourists in Catalonia fell by 4.25 points from 2019 to 2021 (23,8% of the figure for 2019), while the fall in the Balearic Islands fell by 6.64 points (11% of the figure for 2019). These data may mean, as explained below, that tourists from the UK and Germany who did not go to Catalonia could have gone to the Balearic Islands. The situation of Catalonia and Balearic Islands in 2019 can be described by equation (22). After the mobility restrictions in 2021, the new equilibrium can be defined by (30). The share of the potential tourists from the UK and Germany who did not go to Catalonia, $1 - \phi$, can be calculated using these equations. To calibrate (22) and (30) we use the data shown in Table 1. The value of $\sigma = 5$ together with the value of β ensures the stability of the interior equilibria (note that $\tau = 1.6 > 1$).

The differential equations system driving the time evolution of the shares of tourists and firms is presented in Appendix B. The equilibria and their stability are shown in Appendix A.

Balearic Islands, top destination for international tourists this summer (Hosteltur, 6th October 2021) https://www.hosteltur.com/147046 _baleares-destino-ganador-en-turistas-internacionales-este-verano.html

We compare the proportions of tourists in 2019 and 2021 and disregard the data from 2020 due to the collapse of international tourism that year (down around 77% on the previous year) and the total suspension of international travel and tourism activities in April and May.

Table 1.Catalonia vs Balearic Islands

Parameters	Source
$\sigma = 5$	Weng and Wang (2004); Shi and Smyth (2012)
$\beta = 0.68$	Figure calculated from INE official statistics
$\gamma = 0.05$	Figure calculated from the World Tourism Organisation Data
Tourism shares	
$s^*_{T,2019} = 0.586$	Figure calculated from INE official statistics
$s^*_{T,2021} = 0.478$	Figure calculated from INE official statistics
Theoretical result:	$\phi = 0.953$
4.7% of tourists who would have visited Catalonia relocated to the Balearic Islands	

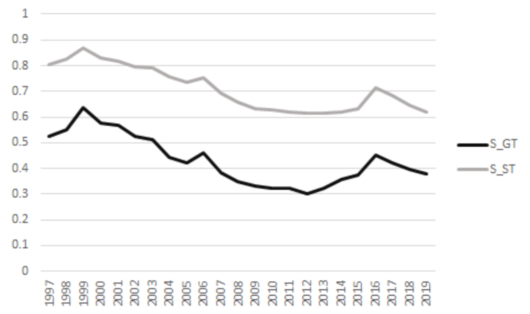


Figure 4. Number of tourists in Spain as a proportion of the total in Spain and Turkey and number in Greece as a proportion of the total for Greece and Turkey.

The figure of $\phi = 0.953$ means that the proportion of international tourists who could have switched from Catalonia to the Balearic Islands in 2021 is $1 - \phi = 0.047$, which fits well with the INE data. According to these data, the difference between the percentage of tourists arriving in Catalonia from the UK and Germany in 2019 and those arriving in 2021 is 4.25%, close to the theoretical prediction of 4.7%.

Since the outbreak of war in Ukraine in February 2022, Russia has been partly isolated from the Western World. Many countries in Europe, Canada and the United States have closed their airspace to Russian airlines. Russia has applied the same measure to flights from the sanctioning countries. Turkey is the most popular tourist destination among Russian tourists, but Spain and Greece have also been key destinations. According to the Statista database, these three Mediterranean destinations were in the Top 10 of the most visited countries in Europe in 2019.

Spain and Greece are among the countries closed to Russian airlines, while Turkey not only has not isolated Russia but has imposed no restrictions. Moreover, Turkish Airlines has increased the number of flights and seats on offer to Russian citizens. Spain and Greece will be unable to count on Russian tourists for the moment and there are reasons to believe that some Russian citizens will change their holiday destinations from Spain or Greece to Turkey in 2022. This situation can also be represented as a change in the mobility of tourists.

We consider Spain and Turkey as two competing countries under the assumptions of our model, and consider Greece and Turkey likewise. According to World Bank Open Data, the number of tourists in Spain as a proportion of the total for Spain and Turkey and the number in Greece as a proportion of the total for Greece and Turkey follow the trends shown in Figure 4.

From 2009 to 2019, tourists in Spain accounted for more than 0.6 of the total figure for Spain and Turkey, showing Spain to be a more popular destination for international tourists than Turkey. In 2016 the figure rose to 0.7 due to the coup attempt in Turkey. The number of tourists in Greece as a proportion of the total for Greece and Turkey increased from 0.3 in 2012 to very close to 0.4 in 2019. The figure for 2016 was even higher. Our model can give insights into the proportion of these tourists in 2022 after the veto on travel from Russia to these two destinations. To calibrate the equations in the model we use the values σ, β and γ given in Table 1 and the data in Table 2.

Table 2. Spain vs Turkey and Greece vs Turkey

Proportions of tourism	
$s^*_{TGT,2019} = 0.38$	Figure calculated from World Bank Open Data
$s^*_{TST,2019} = 0.62$	Figure calculated from World Bank Open Data
Proportion of Russian tourists	
$1 - \phi_G = 0.019$	Figure calculated from Statista platform
$1 - \phi_S = 0.016$	Figure calculated from Statista platform
Theoretical result:	
	$s^*_{TGT,2022} = 0.31$
	$s^*_{TST,2022} = 0.53$

Taking into account that the number of tourists in 2019 as a proportion of the total for Greece and Turkey is $s^*_{TGT,2019} = 0.38$, and as a proportion of the total for Spain and Turkey is $s^*_{TST,2019} = 0.62$, the same method as in the previous example can be used to show that the estimated proportion of tourists in 2022 for Greece vs Turkey is $s^*_{TGT,2022} = 0.31$ and for Spain vs Turkey is $s^*_{TST,2022} = 0.53$. Although these calibrations only show approximate values to the equilibrium shares, they point to a decrease of tourists in Spain and Greece compared to Turkey. This decrease may prove decisive for some destinations. To quote the newspaper *Cinco Días* "Russia is not one of the main outbound markets for tourists to Spain but it is big in terms of spending (with an average outlay per trip of €1,536, 27.5% more than the overall average) and is vital for some areas of Catalonia, such as Girona and Tarragona, which may receive about 800,000 travellers a year". In Greece, the tourist share

We use equation (22) with the share $s^*_{T,2019}$ to obtain the value of Ω. Then, assuming that this value Ω does not change in the next period, it is used in equation (30) together with the data available to obtain the value of the target variable. We implicitly solve the equation with R.

Russian outbound tourism market review (Tourism review news, 19th February 2019) https://www.tourism-review.com/russian-outbound-tourism-industry-news10935

https://www.statista.com/statistics/261729/countries-in-europe-ranked-by-international-tourist-arrivals/

Our starting date in this example is 2019 because data on foreign tourist arrivals to Greece and Turkey in 2020 and 2021 are not available. We acknowledge that 2019 data could differ from the tourists arrivals in 2020 and 2021 because of Covid-19 (most Russian tourists have the Sputnik vaccine, not recognized by the Government of Spain). However, the analysis serves for the purpose of illustration.

Hoteliers expect Russian tourists to flee to Turkey (*Cinco Días*, 1st March 2022) https://cincodias.elpais.com/cincodias/2022/02/28/companias/1646062351_044189.html forecast for 2022 indicates a drop in competitiveness and the same finding is reported by *Neos Kosmos*.

Another situation that can be studied using the model is the case of Madrid and Catalonia. During the pandemic the hospitality sector in Catalonia has suffered more restrictions than in other Spanish regions, e.g. Madrid.

The drop in the cumulative incidence of cases close to Easter led most regions to ease their restrictions to help the hospitality sector, as one of the sectors hardest hit by the economic crisis resulting from the pandemic. However, the restrictions over Easter differed from one region to another. For instance they were much more stringent in Catalonia than in Madrid: while the curfew in Madrid was at 23:00 hours, and hospitality industry establishments were allowed to retain open up to that time, with home-delivery of food permitted until midnight, in Catalonia restaurants and bars were allowed to open to the public only 7:30 to 17:00, with the option to offer take-away services from 19:00 to 22:00 for pick-ups by customers and to 23:00 for home deliveries.

Focusing on the Easter holidays period and using data from the Tourist Movement on Borders Survey (Frontur, INE) for April from 2016 to 2021, the trend in the number of international tourists in Catalonia as a proportion of the total for Catalonia and Madrid is shown in Figure 5. In previous years the figure was about 0.72. Leaving aside Easter 2020 when there was a complete shutdown, in 2021 it fell to 0.58. These data could imply that some tourists decided to change their destination from Catalonia to Madrid due to the differences in the capacity restrictions at the two destinations.

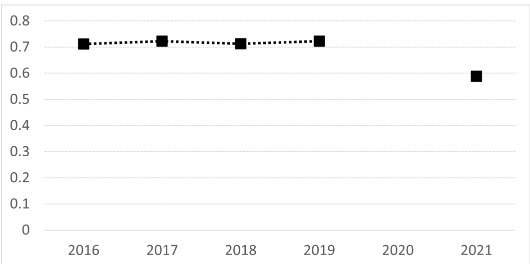


Figure 5. Number of tourists in Catalonia as a proportion of the total for Catalonia and Madrid in April

We take Catalonia as region 1 in our model with restrictions δ_C and Madrid as region 2 with restrictions $\delta_M > \delta_C$. Thus $\delta = \delta_C/\delta_M < 1$. Equations (22) and (29) can be used to illustrate the consequences of capacity constraints at Easter time in 2021. To calibrate these equations we use the values σ, β and γ given in Table 1 and the data shown in Table 3. The figure obtained is $\delta = 0.899$.

Table 3. Catalonia vs Madrid

Tourism shares	Source
$s^*_{T,2019} = 0.723$	Figure calculated from INE official statistics
$s^*_{T,2021} = 0.589$	Figure calculated from INE official statistics
Theoretical result:	$\delta = 0.899$

This figure of $\delta = 0.899$ means that Catalonia performed at 89,9% of the level of Madrid in April 2021. This is coherent with the data on workers registered with the Social Security system as employed in the hotel, catering and travel agency sectors (INE). According to these official statistics, the number of affiliates in April 2021 was 79.4% of the figure for April 2019 in Catalonia, but 88% in Madrid. This implies that Catalonia was operating at 90% of the capacity of Madrid, which is very close to the theoretical result.

The existence of agglomeration economies means that divergences in current tourism proportions cannot be immediately corrected and maintaining stricter restrictions during the pandemic could be the reason for a slower recovery in tourism in Catalonia than in Madrid. This is in line with *RateGain* which predicts that air passenger arrivals to Madrid from April 2022 to June 2022 will be only 33% lower than in the equivalent period of 2019, while the figure for Barcelona will be 48% down.

Concluding remarks

We propose a geography-based dynamic tourism model to explain the long-run equilibrium distribution of international tourism between two competing destinations. We find that economies of scale in the tourism industry and the price index elasticity of the utility for tourists are key parameters for the long-run equilibrium. If economies of scale and the price sensitivity of tourists are high then tourism will be agglomerated at one destination. Economies of scale and price elasticity work in favour of agglomeration, as occurred in pre-pandemic times, when overtourism was of great concern among tourism economists. The basin of attraction of these equilibria grows with environmental and cultural beauty and the size of the local industry and decreases with the price of tourism services. If economies of scale are lower or tourists are not so sensitive to price changes, tourism tends to be evenly distributed between the two regions. In this case, the share of tourism is higher in the nicer or larger region or in the region with the lower prices. The transition from agglomeration to dispersion is abrupt only if the two destinations are identical. In more realistic cases the transition is smooth but becomes steeper as the economies of scale increase. Both, lower economies of scale and lower price index elasticity reduce differences in tourism occupation. Economies of scale will continue to increase in the future because of technological progress, but innovations and new knowledge will also help to develop attractive local goods to counteract agglomeration economies. Sustainable

Greece's tourism industry to suffer effects of Russian invasion of Ukraine (*Neos Kosmos*, 20th February 2022) https://neoskosmos.com/en/2022/02/28/news/greece/greeces-tourism-industry-to-suffer-effects-of-russian-invasion-of-ukraine/

Catalan bars and restaurants have been open 60% less hours than in Madrid since October (*El Periódico,* 13th April 2021) https://www.elperiodico.com/es/barcelona/20210413/bares-restaurantes-catalanes-abren-60-menos-horas-madrid-11653710

Restrictions on the hotel and catering industry in each regional autonomous community (*La Vanguardia*, 15th March 2021) https://www.lavanguardia.com/comer/al-dia/20210315/6375480/restricciones-hosteleria-por-cada-comunidad-autonoma.html

Crystal ball April-June: Madrid recovers better than Barcelona (Hosteltur, 21st April 2022) https://www.hosteltur.com/151131 _bola-de-cristal-abril-junio-madrid-se-recupera-mejor-que-barcelona.html tourism, as opposed to agglomeration, needs such inventions to be developed at local attractions.

Our model is consistent with the well-established Tourism Area Life Cycle theory (Butler, 1980). We prove that if tourists take into account on natural/cultural beauty in the process of choosing one of the two destinations, disregard the variety of tourism services and spend their whole budget on tourism services, the interaction between the two destinations vanishes and our model predicts an S-shaped trend in the number of tourists for each destination, in line with the TALC theory.

We show that the model can be used to examine the effects of some policy measures, such as capacity restrictions and mobility changes. We find that the shares of tourists and tourism firms in the region that imposes/suffers restrictions are lower than in the baseline model with no constraints and the number of tourists per firm in that region is higher than the average at equilibrium. Because of the drop in capital returns, lower tourism occupation will result in a drain of firms from the undermined region to the region with no constraints. Capacity constraints affect not only capital returns but also the utility for tourists, which implies that these two types of policies are not equivalent. Motivated by the covid-19 measures and the outbreak of the war in Ukraine, we calibrate our model with the data available for specific competing destinations: Catalonia versus the Balearic Islands, Spain and Greece versus Turkey and Catalonia versus Madrid. All three cases support and demonstrate the applicability of our model in different settings. Some other measures could be also considered in our model. For instance, local authorities could implement policies supporting local goods and services or could invest in improving the environmental endowment and intangible goods. However, these could possibly be explored in future research.

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Some attempts have been made. For example, establishments in the Balearic Islands must offer 3% of local products (Hosteltur, 9th of May 2022) https://www.hosteltur.com/151402_baleares-obligara-a-los-establecimientos-a-ofrecer-un-3-de-producto-local.html?code=home-page%7B2022-05-09%7D&utm_source=newsletter-es&utm_medium=email&utm_campaign=gonzalez-los-modelos-evolucionan-a-compartir-mas-riesgos-y-beneficios-hosteltur-09-05-2022&utm_term=20220509&utm_content=hoteles-5

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Appendix A: Equilibria and stability

In this appendix we analytically develop the baseline model described in Section and its modifications in Section . Taking into account (7) and (11) in (12) together with (9), the model drive a dynamic system of equations of the form

$$\begin{aligned} \dot{s}_T &= s_T(1-s_T)(E_1(\delta,\phi)-V_2) && \text{(27a)} \\ \dot{s_N} &= s_N\,(1-s_N)\,(\pi_1(\delta,\phi)-\pi_2) = (\delta(\phi-s_N)s_T-(1-s_T)s_N)\,\frac{\beta ET}{\sigma N} && \text{(27b)} \end{aligned}$$

with

$$\begin{aligned} E_1(\delta,\phi) &= \phi V_1(\delta)-(1-\phi)\frac{1+\gamma}{1-s_T}\text{ with } V_1(\delta)=(\delta\beta E)^{\beta}\frac{A_1L_{H_1}^{1-\beta}}{p_1^{\beta}}\frac{s_N^{\frac{\beta}{\sigma-1}}}{s_T^{1-\beta}}\frac{N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}}, && \text{(28a)} \\ V_2 &= (\beta E)^{\beta}\frac{A_2L_{H_2}^{1-\beta}}{p_2^{\beta}}\frac{(1-s_N)^{\frac{\beta}{\sigma-1}}}{(1-s_T)^{1-\beta}}\frac{N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}} && \text{(28b)} \\ \pi_1(\delta,\phi) &= \left(\phi-(1-\phi)\frac{s_N}{1-s_N}\right)\delta\pi_1 = \delta\frac{\beta E}{\sigma}\left(\phi-(1-\phi)\frac{s_N}{1-s_N}\right)\frac{s_T}{s_N}\frac{T}{N}, && \text{(28c)} \\ \pi_2 &= \frac{\beta E}{\sigma}\frac{1-s_T}{1-s_N}\frac{T}{N} && \text{(28d)} \end{aligned}$$

Note that if $\delta=\phi=1$ equation system (27) is equivalent to (19)-(20) in the baseline model. If $\phi<1=\delta$ then it is (35)-(36) in the case of mobility restrictions and if $\phi=1>\delta$ and $\mathcal{E}=\delta_2 E$ is used in place of E, it is (38)-(37) as in the case of capacity constraints.

Long-run equilibria. Note that $\dot{s}_N=0$ if and only if $\delta\,(\phi-s_N)\,s_T=(1-s_T)s_N$. If $\phi=1$ then both agglomeration equilibria ($s_N=s_T=0$ and $s_N=s_T=1$) satisfy the requirement that $\dot{s}_T=\dot{s}_N=0$. However, if $\phi<1$ then $s_N=s_T=0$ is the sole agglomeration equilibrium.

There are also interior equilibria with $s_N\neq 0,1$ and $s_T\neq 0,1$. If $s_N,s_T\in(0,1)$ then equation $\dot{s}_N=0$ is satisfied when

$$\begin{array}{ll} s_N=s_T & \text{if } \delta=\phi=1 \\ s_N=\frac{\delta s_T}{1-(1-\delta)s_T} & \text{if } \delta<1=\phi \\ s_N=\phi s_T & \text{if } \delta=1>\phi \end{array}$$

If this is taken into account in the equation $\dot{s}_T=0$ the interior equilibria are:

$$\begin{array}{ll} s_N^*=s_T^*=s^* & \text{if } \delta=\phi=1 \\ s_N^*=\frac{1}{(\delta\Omega)^{(\sigma-1)/(1-\sigma(1-\beta))}+1} & \\ s_T^*=\frac{1}{\left(\delta^{\sigma\beta/(\sigma-1)}\Omega\right)^{(\sigma-1)/(1-\sigma(1-\beta))}+1} & \text{if } \delta<1=\phi \end{array} \qquad (29)$$

Moreover, if $\delta=1>\phi$ there exists an interior equilibrium that cancels out equations (36)-(35) if and only if

$$\begin{aligned} s_N^* &= \phi s_T^* \\ \Omega\phi^{1+\frac{\beta}{\sigma-1}}s_T^{*\frac{\beta}{\sigma-1}-(1-\beta)} &= \frac{(1-\phi)(1+\gamma)}{1-s_T^*}\frac{p_2^{\beta}}{(\beta E)^{\beta}A_2L_{H_2}^{1-\beta}}\frac{T^{1-\beta}}{N^{\frac{\beta}{\sigma-1}}}+\frac{(1-\phi s_T^*)^{\frac{\beta}{\sigma-1}}}{(1-s_T^*)^{1-\beta}} \\ &= \frac{(1-\phi)(1+\gamma)}{1-s_T^*}+\frac{(1-\phi s_T^*)^{\frac{\beta}{\sigma-1}}}{(1-s_T^*)^{1-\beta}} && \text{(30)} \end{aligned}$$

In equation (30) the value of A_2 has been normalised such that $p_2^{\beta}T^{1-\beta}/(\beta E^{\beta}A_2L_H^{1-\beta}N^{\beta/(\sigma-1)})=1$. The value of A_2 can be freely chosen with no loss of generality. Note that what is really important is the beauty of one destination relative to the other and not the numerical value of A_1 or A_2.

Note that if $\sigma(1-\beta)>1$ then the left hand side (LHS) of the previous equation is a strictly decreasing function of s_T with $\lim_{s_T\to 0^+}$LHS$=+\infty$ and $\lim_{s_T\to 1^-}$LHS$=\Omega\phi^{1+\frac{\beta}{\sigma-1}}>0$. On the other hand, the right hand side (RHS) is strictly increasing and $\lim_{s_T\to 1^-}RHS=+\infty$. There exists a unique interior equilibrium $s_T^*\in(0,1)$ that satisfies equation (30) and $\partial s_T^*/\partial\phi>0$ and $\lim_{\phi\to 0^+}s_T^*=0$.

Stability of the interior long-run equilibria. By differentiating expressions in (28) the following is obtained:

$$
\begin{aligned}
\frac{\partial(E_1(\delta,\phi)\text{-}V_2)}{\partial s_T} &= \text{-}(1\text{-}\beta)(\beta E)^\beta \left(\frac{\phi\delta^\beta A_1 L_{H_1}^{1\text{-}\beta}}{p_1^\beta} \frac{s_N^{\frac{\beta}{\sigma\text{-}1}}}{s_T^{2\text{-}\beta}} + \frac{A_2 L_{H_2}^{1\text{-}\beta}}{p_2^\beta} \frac{(1\text{-}s_N)^{\frac{\beta}{\sigma\text{-}1}}}{(1\text{-}s_T)^{2\text{-}\beta}} \right) \frac{N^{\frac{\beta}{\sigma-1}}}{T^{1\text{-}\beta}} \qquad (31a)\\
&\quad \text{-}(1\text{-}\phi)\frac{1\text{+}\gamma}{(1\text{-}s_T)^2}\\
\frac{\partial(E_1(\delta,\phi)\text{-}V_2)}{\partial s_N} &= \frac{\beta}{\sigma\text{-}1}(\beta E)^\beta \left(\frac{\phi\delta^\beta A_1 L_{H_1}^{1\text{-}\beta}}{p_1^\beta} \frac{s_N^{\frac{\beta}{\sigma\text{-}1}\text{-}1}}{s_T^{1\text{-}\beta}} + \frac{A_2 L_{H_2}^{1\text{-}\beta}}{p_2^\beta} \frac{(1\text{-}s_N)^{\frac{\beta}{\sigma\text{-}1}\text{-}1}}{(1\text{-}s_T)^{1\text{-}\beta}} \right) \frac{N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}} \qquad (31b)
\end{aligned}
$$

$$
\begin{aligned}
\frac{\partial(\pi_1(\delta,\phi)\text{-}\pi_2)}{\partial s_T} &= \frac{\beta E}{\sigma}\left(\left(\phi\text{-}(1\text{-}\phi)\frac{s_N}{1\text{-}s_N}\right)\delta\frac{1}{s_N} + \frac{1}{1\text{-}s_N} \right)\frac{T}{N} \qquad (32a)\\
\frac{\partial(\pi_1(\delta,\phi)\text{-}\pi_2)}{\partial s_N} &= \frac{\beta E}{\sigma}\left(\left(\text{-}\frac{\phi}{s_N^2}\text{-}(1\text{-}\phi)\frac{1}{(1\text{-}s_N)^2}\right)s_T - \frac{1\text{-}s_T}{(1\text{-}s_N)^2} \right)\frac{T}{N} \qquad (32b)
\end{aligned}
$$

The Jacobian matrix at the interior equilibrium is

$$
\begin{aligned}
J^*(1,1) &= \begin{pmatrix} -(1-\beta)\Delta^* & \frac{\beta}{\sigma-1}\Delta^* \\ \frac{\beta E T}{\sigma N} & -\frac{\beta E T}{\sigma N} \end{pmatrix} \text{ if } \delta = \phi = 1\\
J^*(1,\phi) &= \begin{pmatrix} -(1-\beta)\Delta^* & \frac{\beta}{\phi(\sigma-1)}\frac{1-s_T^*}{1-\phi s_T^*}\left(\Delta^* - (1-\phi)\left(\frac{\beta}{1-\beta}+\phi\right)\frac{(1+\gamma)s_T^*}{1-s_T^*}\right) \\ \phi\frac{\beta E T}{\sigma N} & -\frac{\beta E T}{\sigma N} \end{pmatrix} \text{ if } \delta = 1 > \phi\\
J^*(\delta,1) &= \begin{pmatrix} -(1-\beta)\Delta^* & \frac{\beta}{\sigma-1}\delta\left(\frac{s_T^*}{s_N^*}\right)^2\Delta^* \\ (\delta(1-s_N^*)+s_N^*)\frac{\beta E T}{\sigma N} & -(\delta s_T^* + 1 - s_T^*)\frac{\beta E T}{\sigma N} \end{pmatrix} \text{ if } \delta < 1 = \phi,\\
&\quad \text{with } \delta(1-s_N^*)+s_N^* = \frac{s_N^*}{s_T^*} = \delta\frac{1-s_N^*}{1-s_T^*} = \frac{\delta}{\delta s_T^* + (1-s_T^*)} \qquad (33)
\end{aligned}
$$

with

$$
\begin{aligned}
\Delta^* &= \Delta^*(\delta,\phi) = s_T^*(1\text{-}s_T^*)\left(\frac{\phi\delta^\beta A_1 L_{H_1}^{1-\beta}}{p_1^\beta}\frac{s_N^{*\beta/(\sigma\text{-}1)}}{s_T^{*2\text{-}\beta}} + \frac{A_2 L_{H_2}^{1-\beta}}{p_2^\beta}\frac{(1\text{-}s_N^*)^{\beta/(\sigma\text{-}1)}}{(1\text{-}s_T^*)^{2\text{-}\beta}} \right)\frac{(\beta E)^\beta N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}}\\
&\quad + \frac{(1\text{-}\phi)(1\text{+}\gamma)}{1\text{-}\beta}\frac{s_T}{1\text{-}s_T}\\
&= \left(\frac{\phi\delta^\beta A_1 L_{H_1}^{1-\beta}}{p_1^\beta}\frac{s_N^{*\beta/(\sigma\text{-}1)}}{s_T^{*1\text{-}\beta}}(1\text{-}s_T^*) + \frac{A_2 L_{H_2}^{1-\beta}}{p_2^\beta}\frac{(1\text{-}s_N^*)^{\beta/(\sigma-1)}}{(1\text{-}s_T^*)^{1-\beta}}s_T^* \right)\frac{(\beta E)^\beta N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}} + \frac{(1\text{-}\phi)(1\text{+}\gamma)}{1\text{-}\beta}\frac{s_T}{1\text{-}s_T}\\
&= \phi\delta^\beta(\beta E)^\beta\frac{N^{\frac{\beta}{\sigma-1}}}{T^{1-\beta}}\frac{A_1 L_{H_1}^{1-\beta}}{p_1^\beta}\frac{s_N^{*\beta/(\sigma\text{-}1)}}{s_T^{*1-\beta}} + \frac{\beta(1\text{-}\phi)(1\text{+}\gamma)}{1\text{-}\beta}\frac{s_T}{1\text{-}s_T} > 0 \qquad (34)
\end{aligned}
$$

Note that $E_1(\delta,\phi) = V_2$ at an interior steady state, which assures the last equality.

Then $trace(J^*) < 0$ in all three cases and the sign of $\det(J^*)$ is the same as the sign of

$$
\begin{cases}
(1-\beta) - \beta/(\sigma-1) & \text{if } \delta = \phi = 1\\
\left(1-\beta-\frac{\beta}{\sigma-1}\frac{1-s_T^*}{1-\phi s_T^*}\right)\Delta^* + \frac{\beta}{\sigma-1}(1-\phi)\left(\frac{\beta}{1-\beta}+\phi\right)\frac{(1+\gamma)s_T^*}{1-\phi s_T^*} & \text{if } \delta = 1 > \phi\\
(1-\beta) - \frac{\beta}{\sigma-1} & \text{if } \delta < 1 = \phi
\end{cases}
$$

where (33) is taken into account in the last expression.

Thus, (24) ensures that $\det J^*(\delta,\phi) > 0$, for any value of $\delta, \phi \in (0,1]$.

Appendix B: Tourism policies

If country j hosts ϕT_{jt} tourists from the rest of the world at time t and $(1-\phi)T_{jt}$ from a country of origin that prohibits/discourages travel to country j at time $t+\Delta t$, then system (13)-(14) becomes

$$
\begin{aligned}
\dot{T}_1 &= \phi\gamma T_{1_t} + \phi T_{1/2} - T_{2/1} - (1-\phi)T_{1t}\\
\dot{T}_2 &= \gamma(T_{2_t} + (1-\phi)T_{1t}) - \phi T_{1/2} + T_{2/1} + (1-\phi)T_{1t}
\end{aligned}
$$

Note that what is really important is the relative size of the restrictions, δ_1/δ_2. If $\delta_1 < \delta_2$ then the system of differential equations (37) and (38) can be reduced to the system (27) with $\delta = \delta_1/\delta_2 < 1$, $\phi = 1$ and $\mathcal{E} = \delta_2 E$. in place of E.

That is, by (15),

$$\begin{aligned}\dot{T}_1 &= (\phi\gamma - (1-\phi))\,T_1 + (\phi V_1 - V_2)\frac{T_1 T_2}{T} \\ \dot{T}_2 &= \gamma T_2 + (1-\phi)(1+\gamma)T_1 + (V_2 - \phi V_1)\frac{T_1 T_2}{T}\end{aligned}$$

Therefore, the shares of tourists and firms in the case of *mobility restrictions* evolve, not as in (19)-(20), but as in the following system

$$\dot{s}_T = s_T(1-s_T)(\phi V_1 - V_2) - s_T(1-\phi)(1+\gamma) \tag{35}$$

$$\dot{s_N} = s_N\,(1-s_N)\left(\left(\phi - (1-\phi)\frac{s_N}{1-s_N}\right)\pi_1 - \pi_2\right) \tag{36}$$

with V_1 and V_2 as defined in (12) and π_1 and π_2 as in (10).

In the case of *capacity constraints*, the capital migration equation (20) becomes

$$\dot{s_N} = s_N\,(1-s_N)\,(\delta_1\pi_1 - \delta_2\pi_2) \tag{37}$$

with $\delta_j \in (0,1)$ and π_j as defined in (10). The trend in the share of tourists will be driven by

$$\dot{s}_T = s_T(1-s_T)(V_1(\delta_1) - V_2(\delta_2)) \tag{38}$$

which is taking into account the effect of capacity constraints in indirect utility.