



# Economics of Sustainable Tourism

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# Contents

<i>List of contributors</i>	vii
<b>The economics of sustainable tourism: an overview</b>	1
FABIO CERINA, ANIL MARKANDYA AND MICHAEL MCALEER	
<b>PART I</b>	
<b>Tourism demand and the host community</b>	7
<b>1 Time series modelling of tourism demand from the United States, Japan and Malaysia to Thailand</b>	9
YAOVARATE CHAOVANAPHOONPHOL, CHRISTINE LIM, MICHAEL MCALEER AND AREE WIBOONPONGSE	
<b>2 Determinants of tourist satisfaction at sun and sand mass destinations</b>	24
JOAQUÍN ALEGRE MARTÍN AND JAUME GARAU TABERNER	
<b>3 Determinant attitudes to tourism in a mass tourist destination: a comparative-static analysis</b>	41
EUGENI AGUILÓ PÉREZ AND JAUME ROSSELLÓ NADAL	
<b>4 A panel data analysis of residential water demand in a Mediterranean tourist region: the case of Sardinia</b>	58
VANIA STATZU AND ELISABETTA STRAZZERA	
<b>PART II</b>	
<b>Tourism and productivity</b>	77
<b>5 Pollution-averse tourists and growth</b>	79
FABIO CERINA AND SAUVEUR GIANNONI	



vi *Contents*

- 6 On the relationship between tourism and trade** 92  
MARÍA SANTANA GALLEGÓ,  
FRANCISCO J. LEDESMA RODRÍGUEZ AND  
JORGE V. PÉREZ RODRÍGUEZ

- 7 Evaluating labour productivity of diversifying rural tourism:  
evidence from Japan** 108  
YASUO OHE

**PART III**

**Sustainable tourism: environment and cultural heritage  
conservation** 127

- 8 Clustering tourism destinations by means of composite  
indices of sustainability** 129  
JUAN IGNACIO PULIDO FERNÁNDEZ AND  
MARCELINO SÁNCHEZ RIVERO

- 9 Equilibrium dynamics and local indeterminacy in a model of  
sustainable tourism** 151  
GIOVANNI BELLA

- 10 How tourism can help preserve cultural heritage sites:  
constructing optimal entrance fee schemes to collect visitors’  
WTP for the World Heritage Site My Son in Vietnam** 168  
TRAN HUU TUAN AND STÅLE NAVRUD

- The economics of sustainable tourism: summary and  
suggestions for future research** 187  
FABIO CERINA, ANIL MARKANDYA AND MICHAEL MCALEER

- Index* 189





## 5 Pollution-averse tourists and growth

*Fabio Cerina and Sauveur Giannoni*

### 5.1 Introduction

The literature on tourism development highlights the role of environmental attractions to explain the success of a destination (Davies and Cahill, 2000; Tisdell, 2001). But developing tourism implies building tourist facilities and receiving a large number of visitors. Tourism development contributes to increasing pollution and might ultimately bring about the destruction of the attraction factor. From this point of view, a positive growth performance by economies that specialize in tourism (Brau *et al.*, 2007) might be interpreted as a phase of transition towards a long-run equilibrium characterized by the death of the destination and a zero-growth performance. The aim of this chapter is to find conditions that avoid this outcome and enable a tourist destination to experience long-term positive growth in the presence of pollution.

We build a growth model in which tourism development generates pollution while tourists are pollution-averse. We establish that long-run positive growth exists only for a particular value of tourists' pollution aversion. Furthermore, we show that intensive use of facilities is associated with a lower growth rate for destinations that specialize in green tourism.

We also see that if the destination can choose the degree of use of facilities, tourism will generate positive growth only if tourists are not too pollution-averse. In this case, the growth rate of the economy will be a negative function of tourists' aversion to pollution, so that the 'greener' the kind of tourism the destination promotes, the slower its growth rate.

This chapter mainly refers to the recent literature strand analysing the dynamic evolution of an economy that specializes in tourism based on natural resources. Among this work, we mention Lozano *et al.* (2008), who build a dynamic general equilibrium model where investment in accommodation capacity and public goods are taken into account; Giannoni and Maupertuis (2007) and Candela and Cellini (2006), who adopt the point of view of a representative tourism firm aiming to maximize its lifetime profit; Rey-Maqueira *et al.* (2005), who analyse the dynamic consequences of the conflict between agricultural and tourism sector for the use of land; Cerina (2007, 2008), who introduces several kind of abatement policies and provides respective analyses of the transitional





dynamics of the economy; and finally Hernández and León (2007), who present a model of tourist life cycle highlighting the interactions between natural resources and physical capital. None of these papers, however, faces the issue of the conditions for endogenous, sustained and sustainable growth in an economy specializing in tourism based on natural resources, which is the issue we deal with here.

The rest of the chapter is organized as follow: section 5.2 describes the analytical structure of our economy, section 5.3 presents a discussion of the growth rate of such an economy, section 5.4 derives the optimal growth rate as a result of central planners' decisions, section 5.5 analyses the consequences of endogenizing the intensity in the utilization of tourism facilities, and section 5.6 concludes the chapter.

## 5.2 The analytical framework

### 5.2.1 Production of the tourism economy

We consider an economy producing only one kind of good (tourism services) which is supplied in an international tourism market in which a large number of tourism economies participate. Tourism services are only sold to non-residents. The production of tourism services implies the building of facilities and the training of human capital in order to make these facilities work. Tourism production is given by the following function

$$T_t^S(k_t) = Ak_t^\eta \quad (5.1)$$

This supply function is a neoclassical production function.  $k$  is the stock of facilities while, for the moment, we simply take  $A$  as a scale parameter. In section 5.5 we will propose an interpretation of  $A$  in terms of intensity in the utilization of tourism facilities. In any case, an increase in  $A$  allows the economy to produce more tourism services with the same stock of capital.  $\eta$  is a parameter reflecting the elasticity of tourism supply with respect to capital. For simplicity, we consider that tourism supply is inelastic with respect to price.

### 5.2.2 Tourists' preferences

We assume that, at any time  $t$ , tourist satisfaction is affected by two factors: the stock of tourism facilities supplied by private tourist operators (accommodation, restaurants, leisure facilities), and  $k_t$ , the quality of the environment, which is measured at each point in time by the intensity of the pollution flow,  $P_t$ .  $P_t$  is an inverse measure of environmental quality: it increases as environmental quality decreases.

In formalizing tourists' preferences, we follow the approach used by Gómez *et al.* (2004), which relies on the hedonic price theory (Rosen, 1974). Given



the above considerations, the willingness to pay (WTP) for tourism services is then given by

$$q_t = \gamma q(k_t, P_t) \quad (5.2)$$

We assume  $\frac{\partial q_t}{\partial k_t} \geq 0$  (the higher  $k_t$ , the higher the quality of the experience for a tourist) and  $\frac{\partial q_t}{\partial P_t} \leq 0$  (the higher the level of pollution, the lower the quality of the experience for a tourist).  $\gamma$  is a scale parameter.<sup>1</sup>

### 5.2.3 The international tourism market, revenues and residents' behaviour

Our economy supplies tourism services in an international tourism market where a large number of small tourism economies participate. It is important to highlight that although international competition fixes the price for a given quality of the services, a country could charge a higher price provided that its services are considered of a higher quality (i.e. characterized by a higher stock of environmental, cultural and social resources) than other countries'. In other words, the international market consists of a continuum of tourism markets differentiated by their quality and the (equilibrium) price paid for the tourism services. In each of them, the suppliers are price-takers but they can move along the quality ladder through changes in their environmental quality and level of facilities.

We assume that each tourist, at any time  $t$ , buys one unit of tourism services so that output at time  $t$  is measured in terms of tourist entries. The supply side of the economy is made up of a large number of identical 'household firms' which we normalize to 1. We assume that the international demand for tourism is infinite for the price level which corresponds to tourists' WTP and is nil for any other price level. So, the market clears all the time and the quantity exchanged is totally determined by the supply side.

Aggregate tourism revenues are represented by the value of the economy's output. If  $P_t$  is the level of tourism inflows at time  $t$ , this is given by

$$TR_t = \gamma_t q(k_t, P_t) T_t$$

### 5.2.4 Pollution

Like Smulders and Gradus (1996), we consider pollution as a flow. We will consider the following functional form:

$$P_t = P(k_t, T_t, Z_t) \quad (5.3)$$



We assume  $\frac{\partial P}{\partial k} \geq 0$ : the construction of facilities generates different kinds of pollution (destruction of biodiversity, visual pollution, waste generation, etc.) that damage the image of the destination. Analogously, we assume  $\frac{\partial P}{\partial T}$  positive since tourist inflows (like facilities) generate pollution due to, for example, the overcrowding of tourism sites. Furthermore, when a tourist pollutes a site, this has a negative impact on the global quality of the experience for other tourists.  $Z$  denotes costless abatement and represents the capacity of each specific destination to 'resist pollution'. It can be considered as a generic variable which can be affected by several other factors such as eco-system features, country-specific characteristics, natural regeneration, different impacts of different kinds of tourism, and so on. Since  $Z$  is meant to gather all the factors that mitigate the effect of  $k$  and  $T$  on pollution, we assume  $\frac{\partial P}{\partial Z} \leq 0$ .

### 5.3 The rate of growth in a tourism economy

We now face the issue of the determinant of the rate of growth in an economy specialized in tourism. Assuming that residents' income is allocated between consumption of an imported good (sold at a unitary price) and investment in facilities, the dynamic budget constraint of our economy can be written as

$$\dot{k} = q_t T_t - c_t$$

The budget constraint implies that

$$\frac{\dot{k}_t}{k_t} = \frac{q_t T_t}{k_t} - \frac{c_t}{k_t} \quad (5.4)$$

Relation (5.4) is quite general and tells us that the growth rate depends positively on income per unit of capital and is negatively affected by the consumption to capital ratio. Therefore, if this economy admits a constant steady-state long-run growth rate, it must be the following:

$$g = \frac{q_{ss} T_{ss}}{k_{ss}} - \frac{c_{ss}}{k_{ss}} \quad (5.5)$$

where  $x_{ss}$  is the steady state value of the variable  $x$ . One can check that the previous condition is verified if, and only if, the income to capital ratio is constant. Hence:

$$\frac{\dot{q}_{ss}}{q_{ss}} + \frac{\dot{T}_{ss}}{T_{ss}} - \frac{\dot{k}_{ss}}{k_{ss}} = 0$$





and since  $\frac{\dot{k}_{ss}}{k_{ss}} = g$ , in the long run we have

$$g = \frac{\dot{q}_{ss}}{q_{ss}} + \frac{\dot{T}_{ss}}{T_{ss}}$$

In the steady state, the rate of growth of the tourism-specialized economy is equal to the sum of the growth rate of tourists' willingness to pay and of the growth rate of tourist inflows. Moreover, in order for  $g$  to be constant, we need

both  $\frac{\dot{q}_{ss}}{q_{ss}} = g_q$  and  $\frac{\dot{T}_{ss}}{T_{ss}} = g_T$  to be constant in the steady state.

Log-differentiating (5.2) and (5.1), we find

$$\begin{aligned} \frac{\dot{T}}{T} &= \frac{\dot{A}}{A} + \eta \frac{\dot{k}_t}{k_t} \\ \frac{\dot{q}_t}{q_t} &= \frac{\dot{\gamma}_t}{\gamma_t} + \frac{q_k k_t}{q(k_t, P_t)} \frac{\dot{k}_t}{k_t} + \frac{q_P P_t}{q(k_t, P_t)} \frac{\dot{P}_t}{P_t} \end{aligned}$$

So, for balanced growth, it must be true that

$$\begin{aligned} g_T &= g_A + \eta g \\ g_q &= g_\gamma + \alpha(k_{ss}, P_{ss})g - \beta(k_{ss}, P_{ss})g_P \end{aligned}$$

where  $g_A$ ,  $g_\gamma$  are the steady-state growth rate of respectively  $A$  and  $\gamma$ . Again, in order for a balanced growth path to exist in a tourism economy, these two values should be constant. Also,

$$\alpha(k_{ss}, P_{ss}) = \frac{q_k(k_{ss}, P_{ss})}{q(k_{ss}, P_{ss})} k_{ss}$$

and

$$\beta(k_{ss}, P_{ss}) = -\frac{q_P(k_{ss}, P_{ss})}{q(k_{ss}, P_{ss})} P_{ss}$$

which are the steady-state values of, respectively, the elasticity of tourists' WTP with respect to facilities and pollution, should be constant too. Since  $k_{ss}$  is not constant,  $P_{ss}$  may not be constant and  $g_P$  may not be zero, we need both  $\alpha(\cdot)$  and  $\beta(\cdot)$  to be constant for *any* value of  $k$  and  $P$ . That means that the only functional form for the WTP which can be compatible with a balanced growth path in a tourist economy is a Cobb–Douglas one. Hence, it must be

$$q(k_t, P_t) = \gamma_t k_t^\alpha P_t^{-\beta}$$

**5.3.1 Growth and pollution**

Substituting for the expression for  $T_{ss}$  and  $q_{ss}$  in Equation 5.5, we find that

$$g = \gamma_{ss} P_{ss}^{-\beta} A_{ss} k_{ss}^{\alpha+\eta-1} - \frac{c_{ss}}{k_{ss}} \quad (5.6)$$

From this expression, we can clearly note that the rate of growth is (negatively) affected by the level of pollution. But what are the determinants of pollution? By log-differentiating (pollution),

$$g_P = \frac{P_k k_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} g + \frac{P_T T_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} g_T + \frac{P_Z Z_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} g_Z$$

but since  $g_T = g_A + \eta g$ , we finally have

$$g_P = g \left( \frac{P_k k_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} + \frac{\eta P_T T_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} \right) + \frac{P_T T_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} g_A + \frac{P_Z Z_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})} g_Z$$

$g_P$  being constant, we again need  $g_Z$ ,  $\frac{P_k k_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})}$ ,  $\frac{\eta P_T T_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})}$  and  $\frac{P_Z Z_{ss}}{P(k_{ss}, T_{ss}, Z_{ss})}$  to be constant too. This is tantamount to saying that the only functional form for pollution that is compatible to a balanced growth path in a tourism economy is a Cobb–Douglas one. Hence, we set  $\phi = \frac{P_k}{P(k_{ss}, T_{ss}, Z_{ss})}$ ,  $\varphi = \frac{\eta P_T}{P(k_{ss}, T_{ss}, Z_{ss})}$  and  $-1 = \frac{P_Z}{P(k_{ss}, T_{ss}, Z_{ss})}$  in order to have

$$P(k_t, T_t, Z_t) = \frac{k_t^\phi T_t^\varphi}{Z_t}$$

which, by using Equation 5.1, becomes

$$P_t = \frac{k_t^{\phi+\varphi\eta} A_t^\varphi}{Z_t}$$

As a consequence,

$$g_P = (\phi + \varphi\eta)g + \varphi g_A - g_Z$$

It is then clear that in order to have constant pollution in the steady state, we need  $Z$  (resistance to pollution) to grow at the rate

$$g_Z = (\phi + \varphi\eta)g + \varphi g_A$$



Hence, in the absence of any abatement effort, environmental quality is doomed to decrease more and more in a tourist economy that experiences a positive and sustained growth in the stock of capital. As long as  $g$  is strictly positive, this is true even if  $g_A = 0$ . Hence, unless we assume some kind of exogenous growth given, for example, by ever-increasing terms of trade ( $g_\gamma$  positive), we cannot have any sustainable tourism (i.e.  $g_T \geq 0$ ,  $g \geq 0$ ,  $g_P \leq 0$ ) without any form of abatement.

### 5.3.2 Restrictions on parameters

By substituting for the new expression for pollution in Equation 5.6, we find

$$g = \gamma_{ss} A_{ss}^{1-\beta\phi} k_{ss}^{\alpha+\eta-1-\beta(\phi+\eta\phi)} Z_{ss}^\beta - \frac{C_{ss}}{k_{ss}} \quad (5.7)$$

This is our final expression for the rate of growth of the economy and it deserves some further explanation.

First, it is clear that not only  $k$  but also  $\gamma$  (the pressure on the relative price of tourism),  $A$  (the capital stock ‘efficiency’) and  $Z$  (resistance to pollution) have an important role in determining the rate of growth of the economy.

Second, since  $\frac{C_{ss}}{k_{ss}}$  is constant,  $\gamma_{ss} A_{ss}^{1-\beta\phi} k_{ss}^{\alpha+\eta-1-\beta(\phi+\eta\phi)} Z_{ss}^\beta$  should be constant too.

An important implication is that different assumptions concerning the dynamic behaviour of  $\gamma$ ,  $A$  and  $Z$  would lead to different requirements that the parameters  $\alpha$ ,  $\beta$ ,  $\phi$ ,  $\eta$  and  $\phi$  should satisfy in order for a balanced growth path to be feasible. Since our aim is to focus on the dynamic properties of a tourist economy that experiences some kind of *endogenous* growth, we exclude any kind of exogenous growth in the model and hence we treat  $\gamma$ ,  $A$  and  $Z$  as constant variables.<sup>2</sup>

When  $\gamma$ ,  $A$  and  $Z$  are exogenously fixed, in order to have constant steady-state growth we need (net) constant returns to scale on the accumulable factor  $k$ .

**Proposition 1:** *A necessary condition in order to have a constant steady-state growth in the long run is to have:*<sup>3</sup>

$$\beta^* = \frac{\alpha + \eta - 1}{(\phi + \eta\phi)}$$

**Proof:** *In order for  $g$  to be constant, it should not be affected by  $k_{ss}$ . That only happens when the exponent of  $k_{ss}$  in equation (7) is null so that  $\alpha - \beta(\phi + \eta\phi) +$*

*$\eta - 1 = 0$ . This will be true if and only if  $\beta = \frac{\alpha + \eta - 1}{(\phi + \eta\phi)}$ .*

Table 5.1 shows how environmental preferences of tourists must evolve through a change in the value of one parameter in order for positive long-term growth to occur. Any increase in love for facilities  $\alpha$  is associated with an increase in hate for pollution. Furthermore, any increase in the elasticity of pollution with respect to facilities  $\phi$  and/or with respect to tourist flows  $\eta$  induces

*Table 5.1* Steady-state analysis of  $\beta^*$ 

	$\alpha$	$\eta$	$\phi$	$\varphi$
$\beta^*$	+	+/-	-	-

a decrease in pollution aversion. The effect of a change in the elasticity of supply with respect to capital  $\eta$  is ambiguous. If  $\phi + (1 - \alpha)\varphi > 0$  (resp.  $< 0$ ) an increase in  $\eta$  leads to an increase (resp. a decrease) in  $\beta^*$ . In particular, we see that when the love for facility is low any increase in  $\eta$  increases  $\beta^*$ .

If we substitute  $\beta$  for  $\beta^*$ , we obtain that the growth rate is simply

$$\frac{\dot{k}}{k} = \gamma A^{1-\beta^*\varphi} Z^{\beta^*} - \frac{c}{k}$$

And this is also true in the steady state so that:

$$g = \gamma A^{1-\beta^*\varphi} Z^{\beta^*} - \frac{c_{ss}}{k_{ss}} \quad (5.8)$$

Even if  $\gamma$ ,  $A$  and  $Z$  are constant variables in our model, it is useful to draw some comparative statics conclusions. In particular, we can easily see that an exogenous increase in  $\gamma$  (higher pressure on the relative price of tourism) will increase the growth rate of the economy. The same conclusion can be drawn concerning the resistance to pollution,  $Z$ : other things being equal, an increase in the capacity of the economy to resist pollution will allow faster growth. As long as we let  $\gamma$  and  $Z$  be 'country-specific' or associated with the particular kind of tourism good produced, they can have a role in explaining some cross-country difference in the growth rate.

As for  $A$ , we can conclude that it is not always good for growth. If  $\beta > \frac{1}{\varphi}$ , a higher level of  $A$  implies a slower growth rate. If pollution aversion and/or the impact of tourists on pollution are too high, the destination grows more slowly as capital become more efficient. This result has some interesting implications as long as we can associate a high level of  $\beta^*$  with green tourism and a low level of  $\beta^*$  with mass tourism. In particular, a destination producing green tourism  $\left(\beta^* > \frac{1}{\varphi}\right)$  will experience high growth rates in the long run provided the efficiency of each unit of capital is low enough. The reverse is true for a destination producing mass tourism.

## 5.4 The optimal growth rate

In the previous section, we established the necessary conditions to obtain a positive and sustained growth. The problem is now to compute this growth rate as a result of residents' maximizing behaviour. Residents' aggregate utility, at time  $t$ ,





is positively influenced by the aggregate level of consumption at time  $t$  of a homogeneous good purchased from abroad at a unitary price  $c_t$ :

$$U_t = \int_t^{\infty} u(c_t) e^{-\rho t} dt = \int_t^{\infty} \ln c_t e^{-\rho t} dt \quad (5.9)$$

We assume there is a benevolent central planner whose objective is to choose the consumption plan in order to maximize (5.9) respecting the dynamic budget constraint which can be expressed as

$$\dot{k} = \gamma A^{1-\beta\phi} k_t^{\alpha+\eta-\beta(\phi+\phi\eta)} Z^\beta - c_t \quad (5.10)$$

In the previous section, we showed that positive constant growth exists only for a particular combination of parameter values such that  $\beta = \beta^*$ . As long as we look for a positive constant growth, we will use  $\beta^*$  instead of  $\beta$ . In this case, the accumulation equation simply becomes

$$\dot{k} = \gamma A^{1-\beta^*\phi} k_t Z^{\beta^*} - c_t \quad (5.11)$$

After we substitute for the value of  $P_t$ , the Hamiltonian looks as follows:

$$H = \ln c + \lambda \left( \gamma A^{1-\beta^*\phi} k_t Z^{\beta^*} - c_t \right)$$

First-order and Euler conditions are the following:

$$\begin{aligned} H_c = 0 & : \frac{1}{\lambda} = c \\ \dot{\lambda} & = \lambda (\rho - \gamma A^{1-\beta^*\phi} Z^{\beta^*}) \end{aligned}$$

From these equations we obtain the growth rate of consumption over time:

$$\frac{\dot{c}}{c} = \gamma A^{1-\beta^*\phi} Z^{\beta^*} - \rho$$

which, in conjunction with Equation 5.11, gives us the dynamic system describing the evolution of the economy over time.

We know that, along the balanced growth path,  $\frac{\dot{c}}{c} = \frac{\dot{k}}{k} = g$ , hence

$$g = \gamma A^{1-\beta^*\phi} Z^{\beta^*} - \rho$$

Equating this equation with Equation 5.8, we find the optimal steady-state consumption to capital ratio, which is equal to

$$\frac{c_{ss}}{k_{ss}} = \rho$$

This model is similar to that of Rebelo (1991). This means that there is no transitional dynamics so that the growth rate is constant over time and that the





consumption to capital ratio is equal to  $\rho$  all along the time-path. But if in the Rebelo model any growth in  $A$  increases the growth rate, it is not the case in our model, owing to tourists' aversion towards pollution.

### 5.5 Endogenous capital efficiency

As long as an increase in  $A$  allows for larger tourist inflows using the same amount of capital stock, it can be interpreted as an increase in the intensity with which existing facilities are used.

From this point of view, the value of  $A$  may be associated with the degree of utilization of the tourism structure – that is, the length of the tourism season.<sup>4</sup> In so far as residents are those who decide how long such facilities should be kept open and available to foreign tourists, the level of  $A$  might be treated as a further control variable. In choosing the optimal value of  $A$ , residents should make a trade-off between its benefits and its costs. A higher value of  $A$  leads to larger tourism inflows and then to higher income and higher growth if  $\left(\beta^* < \frac{1}{\phi}\right)$ .

However, a higher  $A$  entails a higher direct cost (a longer tourism season means harder work, and we assume residents are work-averse) and an indirect cost that is associated with the higher pollution flow due to the increase in tourist inflows.

In this case, residents' utility might be represented by

$$U_t = \int_t^\infty u(c_t, A_t) e^{-\rho t} dt = \int_t^\infty (\ln c_t - A_t^{1+\omega}) e^{-\rho t} dt \quad (5.12)$$

where  $\omega > 0$  and  $1+\omega$  reflects residents' disutility to work. The benevolent planner maximizes (5.12) under the same budget constraint (5.8).

The Hamiltonian of this function is given by

$$H = \ln c - A^{1+\omega} + \lambda \left( \gamma A^{1-\beta^* \phi} k Z^{\beta^*} - c \right)$$

The Maximum principle gives:

$$H_c = 0 : \lambda = \frac{1}{c}$$

$$H_A = 0 : \lambda = \frac{(1+\omega) A^\omega}{\gamma (1-\beta^* \phi) A^{-\beta^* \phi} k Z^{\beta^*}}$$

$$H_k = \rho \lambda - \dot{\lambda} : \dot{\lambda} = \lambda \left( \rho - \gamma A^{1-\beta^* \phi} Z^{\beta^*} \right)$$

We can then obtain the optimal growth rate of consumption:

$$\frac{\dot{c}}{c} = \gamma A^{1-\beta^* \phi} Z^{\beta^*} - \rho$$

As in the previous section, we can check that at every point in time the ratio  $\frac{c}{k}$  is equal to  $\rho$ .





By solving the system, we find that the optimal length of the season  $A$  is constant over time and is equal to:

$$A = \left( \frac{(1 - \beta^* \varphi) \gamma Z^{\beta^*}}{(1 + \omega) \rho} \right)^{\frac{1}{\omega + \beta^* \varphi}}.$$

It is worth observing that a meaningful (positive) value of  $A$  requires  $\beta^* < \frac{1}{\varphi}$ . In other words, if tourists are *too* averse to pollution, residents find it optimal to keep the tourism structure closed for the whole year. An important implication is that, from Equation 5.8, the rate of growth of the economy is always a positive function of the optimal  $A$ .

It is possible to substitute  $A$  for its optimal in the growth rate in order to obtain:

$$g = \gamma^{\frac{1 + \frac{1 - \beta^* \varphi}{\omega + \beta^* \varphi}}{\omega + \beta^* \varphi}} Z^{\beta^* + \frac{1 - \beta^* \varphi}{\omega + \beta^* \varphi}} \left( \frac{1 - \beta^* \varphi}{(1 + \omega) \rho} \right)^{\frac{1 - \beta^* \varphi}{\omega + \beta^* \varphi}} - \rho$$

One can observe that any exogenous increase in the willingness to pay,  $\gamma$ , or in the capacity of the destination to resist pollution,  $Z$ , is beneficial for growth. Moreover, the higher  $\beta^*$ , or tourists' impact on pollution, the slower the growth rate. And, clearly enough, the larger residents' disutility to work,  $\omega$ , the slower the growth rate.

## 5.6 Conclusions

In this chapter, we have investigated the impact of tourists' aversion to pollution on the growth rate of an economy specializing in tourism.

We built a model of optimal growth and we showed that the destination can experience endogenous growth. In fact, there exists for each destination a unique level of pollution aversion ( $\beta^*$ ) that enables the destination to have a positive and constant growth.

Our model is akin to that of Rebelo (1991), but we found that because of pollution aversion, a higher level of productivity of capital is not always associated with a higher growth rate. More precisely, we established that for a destination specializing in green tourism (high level of  $\beta^*$ ), there exists a negative relationship between the 'efficiency of capital' and the rate of growth. It means that an intensive use of the capital stock may be harmful to growth when green tourism is produced.

Furthermore, under the assumption that the destination can choose the length of the season, we observed that if tourists' aversion to pollution is too high, then the growth rate will tend to zero. It means that if tourists really hate pollution, one should not develop tourism unless the destination has some control over abatement policies ( $Z$ ), or the exogenous price dynamic ( $\gamma$ ) is particularly favourable.



We believe this chapter raises some interesting questions and draws some relevant policy issues for an economy facing the choice of specializing in the production of tourism services. The analysis of such problems should be deepened by a framework in which the supply side is modelled in a more detailed way.

## Notes

- 1 An increase in  $\gamma$  might reflect the pressure on the relative price of tourism for any perceived quality of tourism services depending on the interplay between growth in foreign income and the luxury nature of the tourism good (Crouch, 1995; Smeral, 2003) or its small elasticity of substitution with respect to other kinds of goods (Lanza and Pigliaru, 1994, 2000).
- 2 Actually, in the last section we will treat  $A$  as an endogenous variable, and its constancy in the steady state will be a result of consumers' optimization.
- 3 This condition can obviously be expressed in terms of other parameters. The choice to express it in terms of  $\beta$  is suggested by the fact that  $\beta$  can be considered as a sort of policy tool: different values of  $\beta$  mean different preferences towards pollution and therefore a different kind of tourist. The country may influence its own value of  $\beta$  by addressing itself to different kinds of tourism.
- 4 In interpreting an increase in  $A$  as a longer tourism season, we are only considering one particular aspect of it, specifically the increase in the number of tourist *per unit of time* (say a year). We are then leaving aside other important aspects related to the increase in the length of the season, such as the decrease in the concentration of tourists per unit of time (which might have a positive effect on pollution and then on willingness to pay). The analytical framework we propose in this chapter is not suitable for dealing with this complex issue and thus we leave its analysis to future research.

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