ORIGINAL ARTICLE



Avoiding the Dutch Disease in tourism-led economies: reconciling tourism development and sectoral diversification

Federico Inchausti-Sintes¹

Received: 16 March 2022 / Accepted: 7 September 2023 © The Author(s) 2023

Abstract

Although tourism has produced long-term growth and progress, the economic consequences of this economic specialisation, which is summarised by the paradoxical effect known as the Dutch Disease, alongside the worst financial performance in tourism-led economies as a result of the COVID-19 pandemic, indicate the need for diversification in such economies. Previous research has overwhelmingly shown that tourism development results in decreases in traditional exports, overdevelopment of services and marginalises the weight of industry in the economy. Using a theoretical dynamic general equilibrium model, this article demonstrates that the Dutch Disease can be avoided in tourism-led economies, precisely owing to tourism specialisation, and non-tourism development is possible. More importantly, non-tourism development can be achieved by simultaneously enhancing the quality of tourism-based activities to increase international competitiveness.

Keywords General equilibrium theory \cdot Economic growth \cdot Dutch Disease \cdot Economic diversification \cdot Tourism-led economies \cdot Economic development

JEL Classification $F10 \cdot F20 \cdot F43 \cdot Z32$

1 Introduction

Since the 1960s and 1970s, tourism has been key to economic growth for multiple economies, many of which can be considered tourism-led; however, this specialisation generates a series of economic consequences that have been given the intriguing moniker of Dutch Disease (DD). This economic 'illness' was initially associated with economies with natural-resource-based commodities such as oil-exporting countries. However, its effects can be extended to any country or region

Federico Inchausti-Sintes federico.inchausti@ulpgc.es

¹ Facultad. de Economía, Empresa y Turismo, Universidad de Las Palmas de Gran Canaria, C/ SauloTorón s/n, Despacho D. 2.15, Las Palmas de GranCanaria, CP 35017, Spain

Table 1Sectoral share of theBalearic Islands (%)		1930	1975	2015
	Agriculture	27.4	5.7	0.51
	Industry	24	13.3	3.38
	Construction	4.7	12.9	6.06
	Services	43.9	68.1	65.34

Source: Alcaide (2003) and Eurostat, EU

endowed with any kind of export capability that has a significant weight in the economy. In this context, applying different approaches and scopes, extant literature has identified tourism's key economic symptoms (Copeland 1991; Adams and Parmenter 1995; Zhou et al. 1997; Narayan 2004; Chao et al 2006; Blake et al 2006; Capo et al. 2007; Parrilla et al. 2007; Pham et al. 2015; Inchausti-Sintes 2015, 2020), which can be summarised into real exchange rate appreciation, reduction in traditional exports, *deindustrialisation* and strong development of tourism-based activities (non-tradable sectors). These combined consequences restrict future economic growth beyond tourism in such economies.

The productive structure of tourism-led economies is left to navigate the results of this specialisation. Comparing tourism-led economies with wealthy, non-tourism economies, has revealed an overdevelopment of services (the tertiary sector), whereas industry (the secondary sector) has a lesser role (Inchausti-Sintes 2020). On average, industrial and service sectors in tourism-led economies are respectively 0.18 times lower and 1.3 times and higher than their counterparts in wealthy economies. The Spanish Balearic Islands provide a vivid example of this intense economic transition towards tourism specialisation (see Table 1). In 1930, agriculture, industry, construction and services represented 27.4%, 24%, 4.7% and 43.9% of the economy of this archipelago, respectively. However, around a decade and a half after the advent of tourism, in 1975, sectoral shares were respectively 5.7%, 13.3%, 12.9% and 68.1%. Finally, the islands' economic transition is clearly evident in the figures for 2015.

However, notably for some current tourism-led economies, industry already represented a marginal share prior to the advent of tourism. In fact, most of these economies were agriculture-led, with modest income levels. In these cases, tourism did not cause *deindustrialisation* or large-scale sectoral distress, but paved the way for new development and improved socio-economic welfare.

Regardless of the circumstances, lack of sectoral diversification jeopardises the opportunity to boost alternative economic sectors and also compromises long-term growth by concentrating on low-productivity activities, such as services. The latter is particularly contradictory when analysing historical economic development. From this perspective, the economic evidence demonstrates that the transition from low-productivity (labour-intensive sectors with low skill qualifications and salaries) to high-productivity activities (capital- and technology-intensive sectors, where skill-based qualifications and salaries also rise) is a familiar pattern in advanced economies, which enhances both growth and higher salaries (Baier et al. 2006;

Hausmann et al. 2007). Conscious of these potential pitfalls, Gulf nations have already embarked on a path towards diversification to break oil dependence (Cherif et al. 2016).

Increased competition from emerging and cheaper locations is another cause of concern for traditional tourism-led economies. While authors such as Smeral (2003) and Inchausti-Sintes (2020) have noted the advantages of high tourism income elasticity for economies' international competitiveness and sustained longterm growth, the COVID-19 pandemic emphasised the need for diversification in tourism-led societies, as all suffered heavily and experienced delayed recoveries. To date, Chang et al. (2011), Sheng (2011) and Zhang and Yang (2019) have recommended conventional economic policies to address DD in tourism using simulation models. However, while Chang et al. (2011) recommended using tourism tax revenue to provide public services to promote manufacturing activities, the other two articles were ambivalent about the usefulness of subsidising non-tourism activities to alleviate DD. It is unreasonable to assume that sectoral diversification will emerge by simply following economic policies. First, these economies demonstrate comparative advantages in tourism; hence, they expect to keep on receiving tourists, meaning that they will keep on attracting economic resources from tourism activities. Second, as previously noted, tourism has a relevant weight in such economies; hence, any sectoral diversification policy should be developed by acknowledging the importance of tourism.

This article adopts a different approach by theoretically demonstrating that DD can be avoided or 'bridged' in tourism-led economies by (counterintuitively) taking advantage of tourism specialisation without public intervention. Briefly, the proposed approach redirects a share of the capital endowment of tourism/non-tradable activities in tourism-led economies to the tourism/non-tradable sector of foreign economies to boost sectoral diversification in the home economy. In other words, the capital endowment of the tourism sector in the foreign economy is 'satisfied' by the capital endowment of the tourism-led economy (international non-tradable capital mobility).

To date, in both theoretical and empirical analyses, the rents of capital in the tourism sector are obtained domestically. By relaxing this assumption and allowing for the rent of non-tradable capital to be generated both domestically and internationally, important new insights for tourism-led economies emerge. The results demonstrate that *vis-à-vis* an identical tourism shock in both economies, the tourism-led economy ceases to suffer from DD and is capable of diversifying its economy beyond tourism. More importantly, the latter occurs while enhancing quality in tourism-based activities and raising the international competitiveness of the sector. In contrast, the traditional economy begins to experience the symptoms of this economic illness. Overall, the results demonstrate that tourism growth is not always synonymous with a lack of economic diversification in tourism-led economies but can lead to it.

The remainder of this paper is structured as follows. Section 1 reviews the literature on DD. Section 2 covers the explanation of the theoretical model. Section 3 presents the calibration and simulation of the model and discusses the results. Section 4 concludes with a summary of the main findings.

2 Literature review

As proposed by Corden and Neary (1982) and Corden (1984) and using the associated notations, DD begins when an export represents a large share of the economy (the boom sector). Given the export nature of the good/service, its first symptom is a progressive appreciation of the real exchange rate, which reduces the competitiveness of traditional exports (lagging sectors). Second, the economic development that occurs in the boom sector generates a flow of resources from other economic sectors (lagging sectors) towards the former. As a result, lagging sectors suffer from the displacement of resources and investment towards the boom sector, which is called the crowding-out effect. Finally, non-tradable sectors benefit from the expenditure effect caused by rising income in the part of the economy that is growing rapidly. In the long-term, economies that experience these effects suffer stagnation, high inflation and a lack of sectoral diversification (Capo et al. 2007; Algieri 2011; Rajan and Subramanian 2011; or Beine et al. 2012). Torvik (2002), Mehlum et al. (2006), Robinson et al. (2006) and Van der Ploeg (2011) validated these results. However, while the first author stresses the harmful role of rent-seeking in facilitating DD, the remaining authors emphasise the quality of institutions to explain its pervasive effect. Other researchers have also demonstrated positive spillover effects from the booming sector on whole economies (Torvik 2001, 2002; Sachs and Warner 2001; Liu and Wu 2019; and Biørnland et al. 2019).

As noted in the introduction, DD has been associated with oil-exporting countries where the initial blessing of being endowed with abundant crude reserves eventually becomes a curse when the symptoms of this economic illness emerge. As noted, most countries (especially those in the Gulf) have initiated various economic policies aimed at limiting these negative consequences by enhancing sectoral diversification (Cherif et al. 2016). Alternatively, rather than acting when the first symptoms are apparent, the oil-exporting country of Norway is usually cited as an example of successfully avoiding, or at least mitigating, the worst effects, by implementing 'anticipatory policies' in this regard (Larsen 2006).

As an export-based activity, tourism is particularly prone to producing DD. Copeland (1991) and Chao et al. (2006) were the first to theoretically propose the adverse sectoral effects of tourism. Chao et al. (2006) argued that the rise in the prices of non-traded goods triggers resource displacement from manufacturing to the non-traded sector, eroding the demand for domestic capital in the former and causing *deindustrialisation*. Chen et al. (2016) found contradictory results when analysing the economic and welfare impact of DD in a tourism-led economy. First, assuming international lending, a tourism shock triggers the economic illness but has a neutral effect in terms of social welfare. Second, when an economy is financially closed to the rest of the world, the tourism shock improves social welfare only when the tourism sector is capital-intensive, but at the cost of unleashing DD.

At the empirical level, several authors have confirmed tourism's DD effect from different approaches and perspectives (Adams and Parmenter 1995; Zhou et al. 1997;

Narayan 2004; Blake et al. 2006; Parrilla et al. 2007; Capo et al. 2007; Inchausti-Sintes 2015; and Pham et al. 2015). The results can be summarised as real exchange rate appreciation causing lower import costs while increasing exports prices, the result of which causes non-tourism-based exports to falter. Finally, the non-tradable/ tourism-based sectors grow strongly. The particular qualities of tourism's triggering DD notably differ compared with, for instance, oil-exporting goods. In the latter case, the non-tradable sector benefits from the boom because of the expenditure effect caused by rising incomes. Similarly, productivity gains are lower in these sectors, resulting in reduced salaries in the long-term. Nonetheless, according to Smeral (2003) and Inchausti-Sintes (2020), lower productivity can be compensated for through high-income elasticity in tourism to ensure international competitiveness while achieving higher salaries and sustaining long-term economic growth in tourism-led economies. Hence, tourism development should be backed by both quality improvement and rejuvenation policies (Aguiló et al. 2005; Bardolet and Sheldon 2008; and Ivars-Baidal et al. 2013).

3 The model

The structure of the model used in this study can be summarised as follows. The model includes tourism-led and traditional economies, both of which are small open economies (international prices are given) without a public sector that trade internationally with third economies and between one another through the non-tradable capital of the tourism-led economy, as explained below. Both tradable (T) and nontradable (NT) sectors that demand labour (L) and capital (K) as production factors. Both means of production are owned by a representative agent that demands goods for consumption and investment in both economies. The tradable sector in the traditional economy is distinguished between domestic consumption and investment and international production through traditional exports, while it only produces domestically in the tourism-led economy (domestic consumption). The distinction between both economies stresses a previous consequence of tourism specialisation wherein the reduction of traditional exports in tourism-led societies clashes with the traditional economy that is still endowed with a traditional export good. In contrast, production in the non-tradable sector is demanded domestically for consumption and investment and by tourists in both economies.

The central assumption is that the capital of the non-tradable sector in the traditional economy is owned by the tourism-led economy, whereas the remaining demand for capital from other sectors is satisfied by the internal domestic capital endowment. The income generated by the capital in the host (traditional) economy represents a new source of income for the home (tourism-led) economy, causing economic growth and sectoral diversification. Hence, the rent from capital is generated domestically and internationally in the tourism-led economy. Figure 1 depicts the economic structure of the model.



Source: Own elaboration

Fig. 1 Structure of the model

Finally, the main economic consequences of the model predominantly rely on two central assumptions that are encapsulated as follows:

Assumption 1 Full use of factors with perfect labour mobility, while capital is sector-specific.¹

Assumption 2 Factor substitution between the non-tradable capital in both economies (international non-tradable capital mobility).

The consequences of both assumptions are explained and extended in this section through three propositions.

3.1 Demand side

3.1.1 Representative household

The representative household in the tourism-led economy seeks to maximise the sum of discounted utilities over its lifetime (*t*, lower-case) at the rate of β^t , where the instantaneous utility over time $U(C_t, I_t)$ depends on total consumption (C_t) and total investment (I_t), with $\frac{\partial U(C_t, I_t)}{\partial C_t}$, $\frac{\partial U(C_t, I_t)}{\partial I_t} > 0$ and $\frac{\partial^2 U(C_t, I_t)}{\partial^2 C_t}$, $\frac{\partial^2 U(C_t, I_t)}{\partial^2 I_t} \le 0$, meaning that the

¹ The aim of assuming capital as factor-specific also emphasises the economic 'rigidity' faced by tourismled economies in the short/medium term to boost economic diversification. Nonetheless, the main conclusions hold when assuming capital in the tourism-led economy as perfectly mobile.

utility is concave for both variables. More precisely, the instantaneous utility takes the following form: $U(C_t, I_t) = \frac{(\tau C_t^{1-\theta} + (1-\tau)I_t^{1-\theta})}{1-\theta}$ (Eq. (1)) with τ and $(1-\tau)$ denoting the respective consumption shares in the utility and θ referring to the constant intertemporal elasticity of substitution. Finally, the maximisation problem is constrained by the inter-temporal income constraint (M_t) (Eq. (2)) and the motion of capital (Eqs. (3) and (4)), where P_t , P_t^I , w_t , L_t , r_t^T , K_t^T , r_t^{NT} , K_t^{NT} , er_t , ca_t and δ denote final consumption prices, investment prices, salary, labour, the rent of the tradable stock of capital, the tradable stock of capital, the rent of the non-tradable stock of capital, the non-tradable stock of capital depreciation that is assumed to be equal in both economies, respectively. At this stage, both the labour endowment and the stock of tradable capital is supplied inelastically to the market, while the non-tradable stock of capital is separated into the capital supplied to the non-tradable sector of the tourism-led economy (\widetilde{K}_t^{NT}) and the non-tradable sector of the traditional economy (\widetilde{K}_t^{NT*}) as explained in a later corresponding section.

$$\max_{C_t, I_t} \sum_{t=0}^{\infty} \beta^t U(C_t, I_t) \tag{1}$$

s.t. :

$$M_{t} = P_{t}C_{t} + P_{t}^{I}I_{t} = w_{t}L_{t} + r_{t}^{T}K_{t}^{T} + r_{t}^{NT}K_{t}^{NT} + er_{t}ca_{t}$$
(2)

$$K_{t+1}^{NT} = K_t^{NT} + I_t^{NT} - \delta K_t^{NT}$$
(3)

$$K_{t+1}^T = K_t^T + I_t^T - \delta K_t^T \tag{4}$$

where both C_t and I_t are composite goods such that $C_t = C_t^{NTY_{NT}} C_t^{TY_T} C_t^{TY_M}$ and $I_t = I_t^{NT^{\mu_{NT}}} I_t^{T^{\mu_T}} I_t^{CL^{\mu_{Cl}}}$, where superscripts NT, T and M denote non-tradable/services, tradable goods and import goods, respectively, and γ_{NT} , γ_T , γ_M , μ_{NT} and μ_T refer to the respective coefficient shares. Similarly, the household and investment price indices are denoted as $P_t = P_t^{NT^{\gamma_{NT}}} P_t^{T\gamma_T} er_t^{\gamma_M}$ and $P_t^I = P_t^{NT^{\mu_{NT}}} P_t^{T\mu_T} er_t^{\mu_M}$, respectively. Finally, I_t^{CI} denotes the capital income repatriated from the non-tradable sector in the traditional economy, with μ_{CI} denoting its coefficient share.

The representative household in the traditional/foreign economy, which is denoted by an asterisk, adopts the same practices as the former but includes a single capital accumulation process as follows:

$$M_t^* = P_t^* C_t^* + P_t^{t^*} I_t^* = w_t^* L_t^* + r_t^{T^*} K_t^{T^*} + er_t^* ca_t^*$$
(5)

 $^{^2}$ The World Bank database indicates that economies with a proportion of tourism receipts equal to or above 30% of total exports were running deficits of around 60% during the 1974–2016 period.

$$K_{t+1}^{T^*} = K_t^{T^*} + I_t^{T^*} - \delta K_t^{T^*}$$
(6)

where the variables have the same meaning in the traditional economies; however, now C_t^* and I_t^* are composite goods such that $C_t^* = C_t^{NT*Yn^*}C_t^{T*YT^*}C_t^{M*YM^*}$ and $I_t^* = I_t^{NT*HnT^*}I_t^{T*HnT^*}$. Similarly, household and investment price indices are denoted as $P_t^* = P_t^{NT*YnT^*}P_t^{T*YT^*}P_t^{M*YM^*}$ and $P_t^{I*} = P_t^{NT*HnT^*}P_t^{T*HT^*}$, respectively. Considering that the model assumes two small open economies, the current account deficit is assumed to be fixed. Finally, the first-order conditions of these problems yield optimal demands for consumption and investment, whereas labour and capital are supplied with perfect inelastically by each representative household as follows:

First, the expenditure allocation of the household in the tourism-led economy on non-tradable, tradable and imports goods³ (Eqs. (7)-(10)):

$$C_t^{NT} = \gamma_{NT} \frac{1}{P_t^{NT}} C_t \tag{7}$$

$$C_t^T = \gamma_T \frac{1}{P_t^T} C_t \tag{8}$$

$$C_t^M = \gamma_M \frac{1}{er_t} C_t \tag{9}$$

$$C_t = \tau \frac{1}{P_t} M_t \tag{10}$$

Second, the expenditure allocation of the household in the tourism-led economy on non-tradable, tradable and imports goods (Eqs. (11)-(14)):

$$C_{t}^{NT*} = \gamma_{NT}^{*} \frac{1}{P_{t}^{NT*}} C_{t}^{*}$$
(11)

$$C_{t}^{T*} = \gamma_{T}^{*} \frac{1}{P_{t}^{T*}} C_{t}^{*}$$
(12)

$$C_{t}^{M*} = \gamma_{M}^{*} \frac{1}{er_{t}^{*}} C_{t}^{*}$$
(13)

$$C_t^* = \tau^* \frac{1}{P_t^*} M_t^*$$
(14)

³ The investment decision is explained under 'production' in the *investment sector* sub-section.

3.1.2 Tourists

Both economies receive tourists who demand non-tradable goods/services $(C_t^{tour,NT})$ and imports $(C_t^{tour,M})$ with the utility taking the following form: $U^{tour}(C_t^{tour}) = \frac{C_t^{tour,1-\theta}}{1-\theta}$, with $C_t^{tour} = C_t^{tour,NT^{\vartheta_{NT}}} C_t^{tour,M^{\vartheta_{M}}}$, where ϑ_{NT} and ϑ_M denotes the respective consumption shares. Similarly, the tourism price index is denoted as $P_t^{tour} = P_t^{tour,NT^{\vartheta_{NT}}} P_t^{tour,M^{\vartheta_{M}}}$. The maximisation problem is as follows:

$$\max_{C_t, I_t} \sum_{t=0}^{\infty} \beta^t U^{tour}(C_t^{tour})$$
(15)

$$s.t.: C_t^{tour} = er_t tex_t$$
(16)

where tex_t denotes the tourism budget which is multiplied by the exchange rate er_t to be converted into domestic currency. The solution to this problem, which yields the tourists' allocation of expenditure on non-tradable and import goods, is as follows:

$$C_t^{tour,NT} = \vartheta_{NT} \frac{1}{P_t^{NT}} C_t^{tour}$$
(17)

$$C_t^{tour,M} = \vartheta_M \frac{1}{er_t} C_t^{tour}$$
(18)

$$C_t^{tour} = \frac{1}{P_t^{tour}} er_t tex_t$$
(19)

3.2 Production side

As explained, both economies are endowed with tradable (T, upper-case) and non-tradable (NT) sectors. The goods produced by the tradable sector (Y_t^T) are supplied domestically to emphasise the tourism dependence.⁴ Its counterpart in the traditional economy (Y_t^{T*}) is supplied both domestically and internationally. The non-tradable good $(Y_t^{NT} \text{ and } Y_t^{NT*})$ is demanded domestically by the representative household and by tourists in both economies. Both sectors demand labour (L) and capital (K) as factors of production. The tradable sector is capital-intensive $(Y_t^T = F^T(K_t^T, L_t^T), \text{ with } \frac{K_t^T}{Y_t^T} > \frac{L_t^T}{Y_t^T})$, while the non-tradable is labour-intensive $((Y_t^T = F^{NT}(K_t^{NT}, L_t^{NT}), \text{ with } \frac{K_t^N}{Y_t^N} < \frac{L_t^N}{Y_t^N}))$ in both economies. The production functions are strictly increasing, strictly concave and twice differentiable with positive first derivatives $\left(\frac{\partial F}{\partial K} > 0, \frac{\partial F}{\partial L} > 0\right)$ and negative second deriva-

⁴ The main conclusions hold when assuming exports in this sector.

tives $\left(\frac{\partial^2 F}{\partial K \partial K} < 0, \text{ and } \frac{\partial^2 F}{\partial L \partial L} < 0\right)$. In addition, the production functions satisfy the Inada conditions $\left(\lim_{k \to 0} \frac{\partial F}{\partial K} = \infty, \lim_{k \to \infty} \frac{\partial F}{\partial K} = 0, \lim_{L \to 0} \frac{\partial F}{\partial L} = \infty, \lim_{L \to \infty} \frac{\partial F}{\partial L} = 0\right)$ and show constant return to scale. Finally, the demand for capital in the tradable sector of the traditional sector is satisfied with part of the capital (K_t^{NT}) of the tourism-led economy. Specifically, the latter is demanded by both non-tradable sectors in both economies. Algebraically, the maximising profit problem of both sectors are as follows:

3.2.1 The tradable sector

As explained, the tradable sector in the tourism-led economy (Y_t^T) only produces domestically according to the following maximising problem (Eqs. (20) and (21)):

$$\max_{Y_{t}^{T}, L_{t}^{T}, K_{t}^{T}} P_{t}^{T} Y_{t}^{T} - w_{t} L_{t}^{T} - r_{t}^{T} K_{t}^{T}$$
(20)

$$s.t: Y_t^T = F^T(K_t^T, L_t^T) = K_t^{T^{\alpha_{k_T}}} L_t^{T^{\alpha_{k_T}}}$$
(21)

where P_t^T denotes the price of the tradable good, and α_{K_T} and α_{L_T} are the coefficient shares of the production function. In the traditional economy, the tradable sector produces and supplies its production according to the two-step maximisation problem (Gilbert and Tower 2013) below (Eqs. (22) and (23)). First, the sector decides the optimal production of the goods $(Y_t^{T^*})$ and the optimal demand of factors $(L_t^{T^*})$ and $K_t^{T^*}$). Second, given the previous optimal value of $Y_t^{T^*} = \overline{Y}_t^{T^*}$, in this second step the sector decides the optimal production supplied domestically $(Y_t^{D^*})$ and internationally $(Y_t^{X^*})$. Given the small open economy assumption, the international prices of the exports are assumed as given.

First step:

$$\max_{Y_t^{T^*}, L_t^{T^*}, K_t^{T^*}} P_t^{T^*} Y_t^{T^*} - w_t^* L_t^{T^*} - r_t^{T^*} K_t^{T^*}$$
(22)

s.t:
$$Y_t^{T^*} = F^{T^*}(K_t^{T^*}, L_t^{T^*}) = K_t^{T^* \alpha_{K_T}^*} L_t^{T^* \alpha_{L_T}^*}$$
 (23)

where $P_t^{T^*}$ denotes the price of the tradable good. The demand for labour and capital; and the supply of the good in this sector is as follows:

$$L_t^{T^*} = \alpha_{L_T} * \frac{P_t^{T^*} Y_t^{T^*}}{w_t^*}$$
(24)

$$K_t^{T^*} = \alpha_{K_T} * \frac{P_t^{T^*} Y_t^{T^*}}{r_t^{T^*}}$$
(25)

$$Y_{t}^{T^{*}} = \left(\alpha_{K_{T}}^{*} \frac{P_{t}^{T^{*}}Y_{t}^{T^{*}}}{r_{t}^{T^{*}}}\right)^{\alpha_{K_{T}}^{*}} \left(\alpha_{L_{T}}^{*} \frac{P_{t}^{T^{*}}Y_{t}^{T^{*}}}{w_{t}^{*}}\right)^{\alpha_{L_{T}}^{*}}$$
(26)

Second step:

$$\max_{Y_{t}^{D^{*}}Y_{t}^{X^{*}}} \gamma_{Tr} \left[\delta^{D^{*}} Y_{t}^{D^{*}Tr} + (1 - \delta^{D^{*}}) Y_{t}^{X^{*}Tr} \right]^{\frac{1}{Tr}}$$
(27)

$$s.t: P_t^{D^*} Y_t^{D^*} + P_t^{X^*} Y_t^{X^*} = P_t^{T^*} \overline{Y}_t^{T^*}$$
(28)

where $\overline{Y}_{t}^{T^{*}}$ is either transformed into domestic production $(Y_{t}^{D^{*}})$ or exports $(Y_{t}^{X^{*}})$ according to Eq. (27), where γ_{Tr} denotes a scale factor $(\delta^{D^{*}})$, $(1 - \delta^{D^{*}})$ represents the share of the domestic and export production in $\overline{Y}_{t}^{T^{*}}$ and Tr refers to the elasticity of transformation between both goods which takes values between $1 < T_{r} < \infty$, ensuring that the function is convex.⁵ Similarly, Eq. (28) refers to the supply constraint, meaning that the values of domestic production and exports equal the value of total supply. As expected, both $Y_{t}^{D^{*}}$ and $Y_{t}^{X^{*}}$ equate with respective demand $(C_{t}^{*}$ and $C_{t}^{X^{*}})$. Finally, $P_{t}^{D^{*}}$ and $P_{t}^{X^{*}}$ refer to the domestic and export production prices,⁶ respectively. The first-order conditions of this maximisation problem yield the domestic and foreign supply functions as follows:

$$Y_{t}^{X^{*}}\left(P_{t}^{X^{*}}, P_{t}^{D^{*}}, \overline{Y}_{t}^{T^{*}}\right) = \gamma_{Tr} \frac{\delta^{X^{*}\delta - 1}}{P_{t}^{X^{*}\delta} + P_{t}^{D^{*}\delta}} \overline{Y}_{t}^{T^{*}}$$
(29)

$$Y_{t}^{D^{*}}\left(P_{t}^{X^{*}}, P_{t}^{D^{*}}, \overline{Y}_{t}^{T^{*}}\right) = \gamma_{Tr} \frac{\left(1 - \delta^{X^{*}}\right)^{\delta - 1} P_{t}^{D^{*}\delta - 1}}{P_{t}^{X^{*}\delta} + P_{t}^{D^{*}\delta}} \overline{Y}_{t}^{T^{*}}$$
(30)

with
$$\delta = \frac{T_r}{T_r - 1}$$

3.2.2 The non-tradable sector

As noted above, the non-tradable sector of the traditional economy demands capital from the tourism-led economy (K_t^{D,NT^*}) , which is obtained after disentangling the

⁵ As noted by Gilbert and Tower (2013), this function is similar to the constant elasticity of substitution function, but with the latter employing an elasticity with values between $-\infty$ and 0, ensuring that the function is concave.

⁶ Given that international prices are assumed exogenously and equal to one, $P_t^{X^*} = er_t^*$.

stock of non-tradable capital (K_t^{NT}) into \widetilde{K}_t^{NT} and \widetilde{K}_t^{NT*} (Eq. (31)), representing the capital supplied to the non-tradable sector from the tourism-led economy and the non-tradable sector of the traditional economy, respectively. The model is also run assuming that all (tradable and non-tradable) capital of the tourism-led economy is disentangled into \widetilde{K}_t^T , \widetilde{K}_t^{NT} and \widetilde{K}_t^{NT*} , yielding the same results. This model assumes that different kinds of capital are supplied with a certain degree of substitution, instead of considering them to be sector-specific. The formulation can be briefly represented as follows:

$$\max_{\widetilde{K}_{t}^{NT}, \widetilde{K}_{t}^{NT*}} \gamma_{Tk} \left[\delta_{K}^{NT} \widetilde{K}_{t}^{NT^{Tk}} + \delta_{\widehat{K}}^{NT} \widetilde{K}_{t}^{NT*^{Tk}} \right]^{\frac{1}{T_{k}}}$$
(31)

$$s.t: r_t^{NT}\widetilde{K}_t^{NT} + er_t\widetilde{K}_t^{NT*} = K_t^{NT}$$
(32)

where γ_{NTk} , δ_K^{NT} , $\delta_{K^*}^{NT}$ and T_{Nk} refer to the previously introduced technical concept, allowing for factor allocation based on assuming non-tradable capital substitution. Concisely, the tourism-led economy supplies non-tradable capital to both economies according to the previous formulation, such that supply equals demand $(\tilde{K}_t^{NT} = K_t^{D,NT})$ and $\tilde{K}_t^{NT*} = K_t^{D,NT^*}$, where $K_t^{D,NT}$ and K_t^{D,NT^*} denote the respective demand for capital in the non-tradable sectors. The first-order conditions of this maximisation problem yield the domestic and foreign non-tradable capital supply functions. The implications of this central assumption are described in more detail through the following propositions.⁷

Proposition 1 (P.1) By owning the non-tradable capital endowment of the traditional economy, the tourism-led economy is capable of diversifying its income source (income effect), which reduces its dependence on domestic tourism incomes, while restraining sectoral displacement caused by a tourism shock (lower crowding-out effect).

Proposition 2 (P.2) A higher elasticity of transformation indicates a higher allocation of non-tradable capital from the tourism-led economy to the traditional economy.

It is important to note that both propositions are intimately related; that is, a higher elasticity of transformation increases the movement of non-tradable capital from the tourism-led economy to the traditional economy (Proposition 2); however, this movement crowds out non-tradable capital supply in the tourism-led economy leaving room for growth in this economy's tradable sector (Proposition 1). Both propositions express the economic mechanism by which DD can be avoided in tourism-led economies.

Following the model, the maximisation problem of the traditional economy's non-tradable sector is as follows:

⁷ The proofs of both propositions are presented in the Appendix.

$$\max_{Y_t^{NT^*}, L_t^{NT^*}, K_t^{NT^*}} P_t^{NT^*} Y_t^{NT^*} - w_t^* L_t^{D, NT^*} - er_t K_t^{D, NT^*}$$
(33)

s.t.:
$$Y_t^{NT^*} = F^{NT^*}(K_t^{D,NT^*}, K_t^{D,NT^*}) = K_t^{NT^* \alpha_{K_{NT}}^*} L_t^{NT^* \alpha_{L_{NT}}^*}$$
 (34)

where $P_t^{NT^*}$, $L_t^{D,NT^*} K_t^{D,NT^*}$, $\alpha_{L_{NT}}^*$ and $\alpha_{K_{NT}}^*$ denote the price of the non-tradable good, the demand of labour and capital and the respective coefficient shares in the traditional economy, respectively. This maximisation problem yields the optimal labour and capital demand functions of this sector in the traditional/foreign economy as follows:

$$L_{t}^{NT^{*}} = \alpha_{L_{NT}}^{*} \frac{P_{t}^{NT^{*}} Y_{t}^{NT^{*}}}{w_{t}^{*}}$$
(35)

$$K_{t}^{NT^{*}} = \alpha_{K_{NT}}^{*} \frac{P_{t}^{NT^{*}} Y_{t}^{NT^{*}}}{er_{t}}$$
(36)

$$Y_{t}^{NT^{*}} = \left(\alpha_{K_{NT}}^{*} \frac{P_{t}^{NT^{*}} Y_{t}^{NT^{*}}}{er_{t}}\right)^{\alpha_{K_{NT}}^{*}} \left(\alpha_{L_{NT}}^{*} \frac{P_{t}^{NT^{*}} Y_{t}^{NT^{*}}}{w_{t}^{*}}\right)^{\alpha_{L_{NT}}^{*}}$$
(37)

The maximisation problem of the tourism-led economy's non-tradable sector is as follows:

$$\max_{Y_t^{NT}, L_t^{NT}, K_t^{NT}} P_t^{NT} Y_t^{NT} - w_t L_t^{D,NT} - r_t K_t^{D,NT}$$
(38)

$$s.t.: Y_t^{NT} = F^{NT}(K_t^{NT}, K_t^{NT}) = K_t^{NT^{\alpha_{K_{NT}}}} L_t^{NT^{\alpha_{L_{NT}}}}$$
(39)

where P_t^{NT} , $L_t^{D,NT}$ and $K_t^{D,NT}$ denote the price of the non-tradable good and the demand of labour and capital in the tourism-led economy, respectively. This maximisation problem yields the optimal labour and capital demand functions of this sector in the tourism-led economy as follows:

$$L_t^{NT} = \alpha_{L_{NT}} \frac{P_t^{NT} Y_t^{NT}}{w_t}$$

$$\tag{40}$$

$$K_t^{NT} = \alpha_{K_{NT}} \frac{P_t^{NT} Y_t^{NT}}{r_t}$$
(41)

$$Y_t^{NT^*} = \left(\alpha_{L_{NT}} \frac{P_t^{NT} Y_t^{NT}}{w_t}\right)^{\alpha_{L_{NT}}} \left(\alpha_{K_{NT}} \frac{P_t^{NT} Y_t^{NT}}{r_t}\right)^{\alpha_{K_{NT}}}$$
(42)

3.2.3 The investment sector

Finally, each sector's production is devoted to satisfying consumption and investment. The investment sector is modelled as follows:

$$\max_{I_t,Y_t^T,Y_t^T} P_t^I I_t - P_t^T I_t^T - P_t^{NT} I_t^{NT} - er_t I_t^{CI}$$
(43)

s.t.:
$$I_t = F^{INV}(I_t^T, I_t^{NT}, I_t^{CI}) = I_t^{NT\mu_{NT}} I_t^{T\mu_T} I_t^{CI\mu_{CI}}$$
 (44)

where I_t , $Y_t^{INV,T}$ and $Y_t^{INV,NT}$ refer to the total investment and the investment demand of tradable and non-tradable goods in the tourism-led economy, respectively. I_t^{CI} refers to the capital income repatriated from the non-tradable sector in the traditional economy. Notably, I_t^{CI} is not forced to invest in the tradable sector. The first-order conditions of this problem yield the optimal investment demand for tradable and non-tradable goods, and capital income and the investment supply function in the tourism-led economy as follows:

$$I_t^T = \mu_T \frac{P_t^I I_t}{P_t^T} \tag{45}$$

$$I_t^{NT} = \mu_{NT} \frac{P_t^I I_t}{P_t^{NT}}$$
(46)

$$I_t^{CI} = \mu_{CI} \frac{P_t^I I_t}{e r_t} \tag{47}$$

$$I_{t} = \left(\mu_{T} \frac{P_{t}^{I} I_{t}}{P_{t}^{T}}\right)^{\mu_{T}} \left(\mu_{NT} \frac{P_{t}^{I} I_{t}}{P_{t}^{NT}}\right)^{\mu_{NT}} \left(\mu_{CI} \frac{P_{t}^{I} I_{t}}{er_{t}}\right)^{\mu_{CI}}$$
(48)

For the traditional economy, the investment sector operates according to the following maximisation problem:

$$\max_{I_t^*, I_t^{T^*}, I_t^{NT^*}} P_t^{I^*} I_t^* - P_t^{T^*} I_t^{T^*} - P_t^{NT^*} I_t^{NT^*}$$
(49)

s.t.:
$$I_t^* = F^{INV^*}(I_t^{T^*}, I_t^{NT^*}) = I_t^{NT^*\mu_{NT}^*}I_t^{T^*\mu_{NT}^*}$$
 (50)

where I_t^* , $I_t^{T^*}$ and $I_t^{NT^*}$ refer to the total investment and the investment demand of tradable and non-tradable goods in the traditional economy, respectively. The first-order conditions of this problem yield the optimal investment demand for tradable and non-tradable goods, and capital income and the investment supply function in the traditional/foreign economy as follows:

$$I_t^{T^*} = \mu_T^* \frac{P_t^{I^*} I_t^*}{P_t^{T^*}}$$
(51)

$$I_t^{NT^*} = \mu_{NT}^* \frac{P_t^{**} I_t^*}{P_t^{NT^*}}$$
(52)

$$I_{t}^{*} = \left(\mu_{T}^{*} \frac{P_{t}^{I^{*}} I_{t}^{*}}{P_{t}^{T^{*}}}\right)^{\mu_{T}^{*}} \left(\mu_{NT}^{*} \frac{P_{t}^{I^{*}} I_{t}^{*}}{P_{t}^{NT^{*}}}\right)^{\mu_{NT}^{*}}$$
(53)

3.2.4 Foreign capital closure

Recall that both economies trade internationally with respective third countries and between one another. Consequently, the following equations must be added to close the foreign position of both economies (balance the balance of payment):

$$\max_{Y_{t}^{NT}, L_{t}^{NT}, K_{t}^{NT}} er_{t} C I_{t}^{NT} - er_{t}^{*} C I_{t}^{NT^{*}}$$
(54)

$$s.t.: CI_t^{NT} = F^{CI}(CI_t^{NT^*}) = CI_t^{NT^*}$$
(55)

These equations represent the repatriation of the capital income obtained from the non-tradable sector $(CI_t^{NT^*})$ in the traditional economy that will be employed as investment in the tourism-led economy (CI_t^{NT}) . Hence, the following equivalence arises from the first-order condition:

$$er_t^* C I_t^{NT^*} = er_t C I_t^{NT}$$
(56)

To ensure the circular flow of income and close the model, the market clearance conditions in both economies must be fulfilled as shown in the Appendix. Finally, once the entire model and the main assumptions have been explained, a central result must be proved, which is summarised in the following proposition.⁸

Proposition 3 (P.3) Tourism income elasticity $(\epsilon_{NT}^{tour}) > 1^9$ reduces DD by crowdingout domestic non-tradable demand towards the tradable sector.

This proposition is key for tourism-led economies because it allows them to reconcile the need for rejuvenation in mature tourism destinations (to maintain

⁸ The proof of this proposition is presented in the Appendix.

⁹ Tourism income elasticity higher than 1 (luxury good) has been extensively demonstrated in the literature (Martin and Witt 1987; Song et al. 2000; Smeral 2003, 2004; Algieri and Kanellopoulou 2009; Falk 2014; Untong et al. 2015; or Inchausti-Sintes et al. 2021).

Parameters	Tourism-led economy	Traditional economy
α_{L_T}	0.2	0.34
$\alpha_{K_{\tau}}$	0.8	0.66
$\alpha_{L_{NT}}$	0.55	0.55
$\alpha_{K_{NT}}$	0.45	0.45
δ^{D}	-	0.62
δ_{K}^{NT}	0.5	-
$\delta_{K^*}^{NT}$	0.5	-
τ	0.48	0.65
γ_T	0.3	0.3
γ_{NT}	0.54	0.54
Υ _M	0.16	0.16
μ_T	0.15	0.68
μ_{NT}	0.5	0.32
μ_{CI}	0.35	-
ϑ_{NT}	0.75	0.75
ϑ_M	0.25	0.25
β	1	1
θ	1	1
T_{Nk}	1	1
Tr	1	1
δ	0.05	0.05
g	0.02	0.02
i	0.016	0.016

Table 2	Calibrated	parameters
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Source: Own elaboration

international competitiveness) with sectoral diversification. Additionally, it allows tourism-led economies to distinguish their growth patterns from other kinds of export-led economies with income elasticity which is typical of commodities (normal or inferior goods).

Finally, this proposition resembles Proposition 1 in some ways by precisely allowing for the rise in demand in the tradable sector to be satisfied because of the increase in demand in the tradable sector to be satisfied by factor mobility.

4 Calibration, simulation and results

Table 2 presents the value of the parameters of both economies that were used for calibration and simulation.¹⁰ The model requires defining the capital depreciation rate (δ), economic growth (g) and interest rate (i) that are compatible with

¹⁰ The data and model are available upon request.

maintaining the steady-state of both economies. All prices are initially equal to 1, and the tourism-led economies' consumer price is assumed as the *numeraire*. Subsequently, all of the prices are in real terms with respect to the latter. The simulated shock is equivalent in both economies and assumes a 10% increase in tourism arrivals in each period, while its magnitude allows us to yield the results.

As shown in Fig. 2, the tourism-led economy is capable of fostering the tradable sector despite the tourism shock (Proposition 1). This result demonstrates that tourism development is not detrimental to economic diversification; hence, DD can be curbed in such economies. In fact, both tradable and non-tradable sectors grow with tourism shock, implying that *industrialisation* is achievable in tourismled economies. The robustness of this alternative tourism growth is confirmed by noting that investment in the tradable sector also grows (see Fig. 2). In contrast, the same tourism shock in the traditional economy triggers DD through real exchange rate appreciation (albeit with a tendency towards depreciation), reduction in traditional/tradable exports and in the tradable sector and finally growth in the non-tradable sector (see Fig. 3). Finally, real wages yield positive values but exhibit a downwards trend in the traditional economy.

The model was also run with different assumptions to test the robustness of the results and enrich the analysis. Specifically, the model assumes tourism income elasticity higher than 1 (*luxury* goods) to stress the capacity to conciliate both tourism development and economic diversification (Proposition 3). Figure 4 confirms that the results and conclusions hold. Higher tourism income elasticity intensifies economic impact (dashed line), demonstrating no trade-off between economic diversification and quality improvement in the tourism sector. In other words, rejuvenation to maintain international competitiveness in mature tourism destinations can be achieved while fostering tradable activities.

To stress the positive consequences of Proposition 2, the model was run assuming a higher elasticity of transformation of the non-tradable capital (T_k) (dashed line). As shown in Fig. 4, the results mirror those in Fig. 2 but the impact increases with higher elasticity (Fig. 5).

Finally, note that using other initial values led to different results in absolute terms but the main insights and conclusions hold. For instance, assuming a higher initial value for the non-tradable sector in the tourism-led economy would have a greater effect in this sector but the general results and conclusions remain the same real exchange appreciation, which increases in both non-tradable and tradable sectors and/or an improvement in investment in the latter. The results are also confirmed when introducing exports in the tradable sector in the tourism-led economy, but with slower growth in this sector. Similarly, when assuming that capital is perfectly mobile in the tourism-led economy, growth in the non-tradable sector requires more periods to enter positive digits in the tourism-led economy, but the principal outcomes hold.



Fig. 2 Results of the tourism-led economy (% deviations from the steady-state)



Fig. 3 Results of the traditional economy (% deviations from the steady-state)



Fig. 4 Results of the tourism-led economy with varying Tourism Income Elasticities (TIE) (% deviations from the steady-state)



Fig. 5 Results of the tourism-led economy with changes in T_k (% deviations from the steady-state)

5 Conclusions

As an export, and as extensively demonstrated by previous research, tourism triggers DD by appreciating the real exchange rate, eroding traditional exports, causing *deindustrialisation* and fostering non-tradable activities. However, this article has shown that room remains for economic diversification, precisely due to tourism specialisation and without public policies. In this sense, the central assumption of the model is that the non-tradable sector in the tourism-led economy can rent its capital in the traditional economy's non-tradable sector by assuming non-tradable capital mobility. This assumption crowds non-tradable capital supply out in the tourismled economy and leaves room for growth in the economy's tradable sector. Hence, the tourism-led economy is capable of developing the tradable sector, demonstrating that DD can be curbed in such economies.

The robustness of the results is confirmed by analysing investment growth in the tradable sector, revealing that the traditional economy suffers from the classic symptoms of DD following the tourism shock. More importantly, the latter can be achieved by enhancing quality in tourism-based activities to raise the sector's international competitiveness, assuming tourism income elasticity higher than one (i.e. tourism development is not detrimental to sectoral diversification). Nonetheless, any theoretical model rests on assumptions that do not always hold in actual circumstances. Thus, some assumptions were relaxed or imposed to test the robustness of the results; for instance,

when including exports in the tradable sector of the tourism-led economy or assuming capital as perfectly mobile in this economy. Similarly, some parameters' values were altered with the same purpose (changes in the tourism income elasticity and the elasticity of transformation). The main conclusions hold in all cases. However, other considerations also deserve attention and should be addressed in future research. For instance, the behaviour of the real exchange rate when assuming additional trade-pattern economies or the existence of economies of scale in the tradable sector may have a significant influence in enhancing sectoral diversification or triggering DD.

From an economic policy perspective, most contemporary tourism-led economies were not endowed with a well-developed/competitive industrial sector prior to the advent of tourism. This means that the path towards diversification and economic development has been a historic matter of concern in such economies. Briefly, the rationale for the lack of economic development can be found in their distance to international markets, the limited size of domestic markets and/or a high level of dependence on imports (lack of resources). Hence, conventional policies which are oriented to boost and attract traditional activities would fail. However, the new knowledge economy represents a significant opportunity for tourism-based economies to achieve economic sophistication and diversification. Considering the nonexcludable and non-rivalrous nature of knowledge, such activities are less reliant on transport costs, distance to international markets and/or natural resources.

Finally, this article contributes to the field by identifying leading economic forces that may enhance diversification in tourism-led economies. Specifically, the results demonstrate that quality tourism development (introducing tourism rejuvenation policies) is compatible with economic diversification.

Appendix

Proof P.1

We first focus on the tourism-led economy assuming that the whole endowment of non-tradable capital is used domestically ($\tilde{K}_t^{NT*} = 0$; thus, $K_t^{NT} = \tilde{K}_t^{NT}$). Applying the Euler equation, and assuming the production technology at a homogenous of degree 1, production in the tradable and non-tradable sectors in the traditional economy can be written as follows:

$$Y_t^T = F_{K_T} K_t^{D,T} + F_{L_T} L_t^T$$
$$Y_t^{NT} = F_{K_{NT}} K_t^{D,NT} + F_{L_{NT}} L_t^{NT}$$

where F_{K_T} , F_{L_T} , $F_{K_{NT}}$ and $F_{L_{NT}}$ denote the first derivatives of production with respect to the demand of factors in each sector. Assuming non-idle capacity, and considering that the capital is sector-specific ($\Delta K_t^{D,T} = 0$ and $K_t^{D,NT} = 0$) and the model assumes perfect labour mobility, in which any change in production must be satisfied with labour displacement such that $\Delta Y_t^T = F_{L_T} \Delta L_t^T$ and $\Delta Y_t^{NT} = F_{L_{NT}} \Delta L_t^{NT}$. In such circumstances, *ceteris paribus*, a tourism demand shock increases the demand for tradable goods by raising production (Y_t^{NT}) from $Y_t^{NT^0}$ to $Y_t^{NT'}$ $(Y_t^{NT'} > Y_t^{NT^0})$, with $\Delta Y_t^{NT} = Y_t^{NT'} - Y_t^{NT^0} > 0$) causing an equivalent variation in the demand for labour $(L_t^{NT'} > L_t^{NT^0})$, with $\Delta L_t^{NT} = L_t^{NT'} - L_t^{NT^0} > 0$), which, assuming perfect labour mobility, implies that $\Delta L = 0 = \Delta L_t^{NT} + \Delta L_t^T$, or similarly that $\Delta L_t^{NT} = -\Delta L_t^T$, which implies that $\Delta Y_t^T < 0$. Hence, tourism expansion is at the cost of the tradable sector (Y_t^T) .¹¹ Labour displacement also affects the wages in the economy. In this sense, perfect labour mobility implies the following equilibrium in the labour market: $w_t = P_t^T MPL_t^T = P_t^{NT} MPL_t^{NT}$, where MPL_t^T and MPL_t^{NT} denote the marginal product of labour in the tradable sector, respectively. As more labour is used in the non-tradable sector, the marginal product of labour rises. In addition, P_t^N and P_t^T will also change to ensure equilibrium. In summary, while improvement in nominal wages is achieved because of expansion in the non-tradable sector, the overall effect on real wages may be ambiguous depending on the intensity of the price changes.

We next assume that $\widetilde{K}_{t}^{NT*} \neq 0$ such as the total supply of non-tradable capital is supplied domestically and internationally $(K_{t}^{NT} = \widetilde{K}_{t}^{NT} + \widetilde{K}_{t}^{NT*})$. Under a similar positive tourism demand shock, variation in production in the non-tradable sector can be satisfied with changes in capital and labour such as $\Delta Y_{t}^{NT} = F_{K_{NT}} \Delta K_{t}^{D,NT} + F_{L_{NT}} \Delta L_{t}^{NT}$, with $\Delta K_{t}^{D,T} = K_{t}^{NT} - K_{t}^{D,NT*}$, which restrains labour displacement from the tradable to the non-tradable sector. As a result, $\Delta L_{t}^{NT} \neq -\Delta L_{t}^{T}$ in the tourism-led economy and the tradable sector can expand its production, despite the tourism shock.

Proof P.2

The first-order conditions of the maximisation problem yield the supply function of each non-tradable capital as follows:

$$\begin{split} \widetilde{K}_{t}^{NT*}\left(er_{t}, r_{t}^{NT}, K_{t}^{NT}\right) &= \gamma_{NTk} \frac{\delta_{K}^{NT^{\rho-1}} er_{t}^{\rho-1}}{er_{t}^{\rho} + r_{t}^{NT^{\rho}}} K_{NT} \\ \widetilde{K}_{t}^{NT}\left(er_{t}, r_{t}^{NT}, K_{t}^{NT}\right) &= \gamma_{NTk} \frac{\delta_{K^{*}}^{NT^{\rho-1}} r_{t}^{NT^{\rho-1}}}{er_{t}^{\rho} + r_{t}^{NT^{\rho}}} K_{NT} \\ \text{with } \rho &= \frac{T_{Nk}}{T_{Nk} - 1} \end{split}$$

¹¹ This proof also holds when assuming a positive change in the non-tradable sector but is smaller than in the tradable sector.

The matrix of second derivatives (second-order conditions) of this problem with respect to prices is as follows:



Ceteris paribus, a positive tourism demand shock in the traditional economy increases the demand for non-tradable goods, increasing the demand for capital in this sector as well. A higher elasticity of transformation intensifies this impact through $\frac{\partial \tilde{K}_{t}^{NT}}{\partial er} = -\gamma_{NTk} \frac{\delta_{K}^{NT\rho-1} \rho er_{t}^{\rho-1} r_{k}^{NT\rho-1}}{(er_{t}^{\rho} + r_{t}^{NT\rho})^{2}} K_{t}^{NT} < 0$, which increases the allocation of non-tradable capital from the tourism-led economy to the traditional economy.

Proof P.3

The income balance constraint of the tourism-led economy can be presented more compactly as follows¹²:

$$\sum_{i=1}^{n} C_{i}^{j}(p_{i}, M^{j} = I_{i}^{j}(p_{i}^{I}, M^{j}) = M^{j}$$

where C_i^j and I_i^j respectively denote the demand of consumption and investment, which are formed by $C_t^T, C_t^{NT}, C_t^{tour,NT}$ and I_t^T and I_t^{NT} , respectively. With i = T and NT and j = RH and tour, where RH refers to the representative household and tour denotes the tourists in the tourism-led economy.

Deriving the previous equation by the income yields the following:

$$\sum_{i=T}^{NT} \frac{\partial C_i^{I}}{\partial M^{j}} p_i + \frac{\partial I_i^{I}}{\partial M^{j}} p_i^{I} = 1$$

This equation demonstrates that changes in income cause a rearrangement of purchasing choices, while holding the income balance constraint. The previous equation can be rewritten in terms of income elasticity by multiplying and dividing by $\frac{M^{i}}{C_{i}^{i}}$ and $\frac{M^{i}}{t^{i}}$, respectively, as follows:

$$\sum_{i=T}^{NT} \frac{\partial C_i^j}{\partial M^j} p_i \frac{M^j}{C_i^j} \frac{C_i^j}{M^j} + \frac{\partial I_i^j}{\partial M^j} p_i^I \frac{M^j}{i_i^j} \frac{I_i^j}{M^j} = 1$$

And more compactly as follows:

$$\sum_{i=T}^{NT} sh_{C_i}^{j} \varepsilon_{C_i}^{j} + sh_{I_i}^{j} \varepsilon_{I_i}^{j} = 1$$

¹² The time subscript was omitted for the sake of clarity.

where $sh_{C_i}^j$, $sh_{I_i}^j$, $\varepsilon_{C_i}^j$ and $\varepsilon_{I_i}^j$ denote the budget share of consumption $\left(sh_{C_i}^j = \frac{P_i C_i^j}{M^j}\right)$ and investment $\left(sh_{I_i}^j = \frac{p_i^j l_i^j}{M^j}\right)$, and $\varepsilon_{C_i}^j = \frac{\partial C_i^j}{\partial M^j} \frac{M^j}{C_i^j}$ and $\varepsilon_{I_i}^j = \frac{\partial l_i^j}{\partial M^j} \frac{M^j}{l_i^j}$ are the income elasticity of each kind of good. Considering that $\varepsilon_{NT}^{tour} > 1$, while the other elasticities are equal to one, reveals that the non-tradable market incurs excess demand $\left(\sum_{J=RH}^{tour} sh_{C_NT}^j \varepsilon_{C_{NT}}^j + sh_{I_{NT}}^j \varepsilon_{I_{NT}}^j > 1\right)$. However, according to Walras's law, all markets are clear. Hence, to clear the non-tradable market in the tourism-led economy, prices will rise until equilibrium is reached, while the excess demand is allocated in the tradable sector until equilibrium is reached in this market as well.

Market clearance conditions

Tourism-led economy:	Traditional economy:	
$Y_t = Y_t^T + Y_t^{NT};$	$Y_t^{T^*} = Y_t^{D^*} + Y_t^{X^*};$	
$Y_t^T = C_t^T + I_t^T;$	$Y_t^{D^*} = C_t^*;$	
$Y_t^{NT} = C_t^{NT} + C_t^{tour,NT} + I_t^{NT};$	$Y_t^{X^*} = C_t^{X^*};$	
$I_t = I_t^T + I_t^{NT};$	$Y_t^{NT^*} = C_t^{NT^*} + C_t^{tour,NT^*};$	
$C_t = C_t^T + C_t^{NT};$	$I_t^* = I_t^{T^*} + I_t^{NT^*};$	
$K_t^T = K_t^{D,T};$	$C_t^* = C_t^{T^*} + C_t^{NT^*};$	
$L_t = L_t^{D,T} + L_t^{D,NT};$	$K_t^{T^*} = K_t^{D,T^*};$	
$\widetilde{K}_{t}^{NT} = K_{t}^{D,NT};$	$L_{t}^{*} = L_{t}^{D,T^{*}} + L_{t}^{D,NT^{*}};$	
$\widetilde{K}_t^{NT^*} = K_t^{D,NT^*};$	$K_t^{T^*} = K_t^{D,T^*};$	
$C_t^{tour} - C_t^M = ca_t;$	$C_t^{X^*} + C_t^{tour^*} - C_t^{M^*} = ca_t^*;$	

Funding Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

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