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Welfare effects of tourism-driven Dutch disease: The roles of international borrowings and factor intensity

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ABSTRACT

This paper develops a two-sector dynamic general equilibrium model to analyze the welfare implications of the Dutch disease induced by the demand shock arising from a tourism boom. Compared with the existing literature, we introduce two new elements, namely, international borrowings and the relative factor-intensiveness, and examine their interplay with the welfare effects of the Dutch disease. We show that (i) when the household can freely borrow from the world financial market, the Dutch disease will not affect welfare; (ii) when the economy is closed to the world financial market, the Dutch disease is beneficial (harmful) to the residents' welfare if the tourism good sector is capital-intensive (labor-intensive). Moreover, this paper provides a simulation analysis to examine the welfare effect of both the steady-state and the transitional responses arising from a tourism boom.

1. Introduction

International tourism is undoubtedly a flourishing industry the world over. According to a report by the World Tourism Organization (UNWTO), receipts from international tourism in destinations around the world recorded growth of 4% in 2012, reaching a value of US$ 1075 billion. International tourist arrivals also exhibited 4% growth, amounting to 1.035 billion in 2012. Fig. 1 shows the receipts from international tourism during the period 1995–2011. In view of the ongoing globalization, it would be reasonable to expect that the upward trend will continue in the future. For a country dedicated to promoting tourism, such an expansion in tourism is naturally welcomed because more visitors can bring income to the local economy. However, as documented by many studies (e.g., Chang et al., 2011, Gooroochurn and Thea Sinclair, 2005, Schubert, 2009), a tourism boom may also generate undesirable consequences to residents of the host country, such as congestion in regard to tourism-related consumption and infrastructure, and the degradation of environmental quality.

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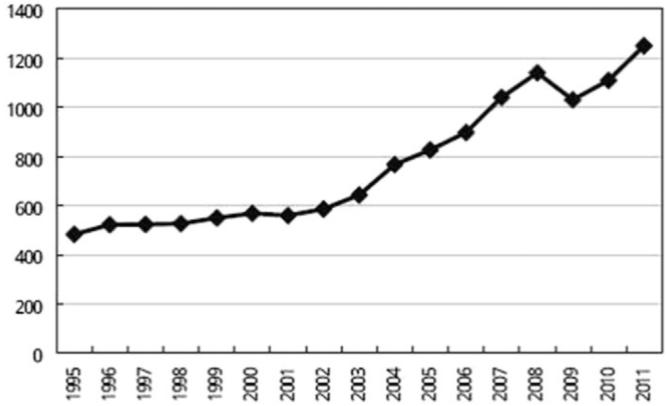

Fig. 1. International tourism receipts (unit: US$ billion). Data Source: The World Bank http://data.worldbank.org/indicator/ST.INT.RCPT.CD/countries?display=graph.

Among those negative consequences caused by the expansion in tourism, the problem of a "Dutch disease" is quite intriguing but has as yet received relatively little attention.[1] Copeland (1991) is the first study to discuss the possibility of the tourism-driven Dutch disease. He emphasizes that tourists normally consume local non-traded goods such as restaurant meals, hotel services, and heritage. With this understanding, a tourism boom tends to boost the demand for these non-traded goods and thus moves the productive factors away from the traded (manufacturing) sector to the non-traded sector. An expansion in the non-traded sector is coupled with a contraction in the traded sector, thereby leading to the emergence of the Dutch disease.

In the previous literature, the results regarding the welfare consequences of the tourism-driven Dutch disease are not conclusive. In his static trade model, Copeland (1991) shows that welfare is improved by a boom in tourism even if the Dutch disease can occur. By developing a two-sector dynamic specific-factor model, Chao et al. (2006) investigate the effects of an expansion in tourism on capital accumulation and welfare. They conclude that the change in welfare following a tourism boom is ambiguous, and the welfare effect could be negative if the loss from the Dutch disease is sufficiently large. Chang et al. (2011) introduce congestion externalities of tourism in a two-sector dynamic model similar to Chao et al. (2006). They show that the presence of congestion will lower the possibility of the Dutch disease. Moreover, the optimal taxation for correcting the externalities of tourism is discussed in their normative analysis.[2]

The aforementioned contributions have some common simplifications. First, as to examining the effect of international tourism, the role of international loans is ignored in these studies. Second, these studies adopt a specific-factor model; particularly, a physical capital input is not needed to produce the tourism goods. In this paper, we drop these two assumptions and study how they interactively affect the welfare implications of the tourism-driven Dutch disease. We show that, when the country is closed to the world financial market, the welfare effect of the Dutch disease depends on the relative factor-intensity in the tourism sector. This welfare effect, however, will be neutralized if the country can borrow from a perfect world financial market.

There are several reasons to justify why it is relevant to introduce international borrowings in the tourism economy. First, the globalization leads not only to the rapid growth of international tourism, but also to the formation of a global financial market, in which international borrowings become easier. Second, the flow of international capital to developing countries follows an upward trend, which displays an increasingly important capital account (Vegh, 2013, p. 672). Third, the empirical evidence shows that FDI in tourism services tends to be sensitive to international borrowing conditions (e.g., Dabla-Norris et al., 2010). Based on these observations, it seems reasonable to bring the role of international financial markets into the picture when we deal with the tourism economy. Accordingly, this paper considers a small open economy model featuring international borrowings, and studies the role played by international borrowings in the welfare effects of the Dutch disease upon experiencing a boom in tourism. We find that, under a small open economy setting, the Dutch disease is welfare neutral in the presence of a perfect capital market. Intuitively speaking, a tourism boom directs resources to the tourism sector. This affects the incentives for capital accumulation, and hence affects consumption and welfare in an economy with no international borrowings. By contrast, in a small open economy with a perfect world capital market, such a linkage is absent because households can borrow from the international capital market (at a fixed cost, i.e., the world interest rate) to offset the change in capital accumulation, so that the level of

[1] The Dutch disease originally refers to the adverse effects on Dutch manufacturing of the natural gas discoveries in the 1960s. The wealth increases following the resource discoveries had a systematic impact on the sectoral allocation of resources, and led to a shift in productive resources from the traded good sector to the non-traded good sector. Previous studies dealing with the possibility of the emergence of the Dutch disease include Corden and Neary (1982); Corden (1984); Torvik (2001), and Matsen and Torvik (2005).

[2] There are some other contributions in this field that are not so directly related to our present paper. Hazari et al. (2003); Nowak et al. (2003) and Nowak and Sahli (2007) use static models to examine the welfare effect of a tourism boom. Chao et al., (2010a) consider a three-good static model and use it to examine the optimal import quotas in an economy with tourism. Chao et al. (2010b) focus on the effects of foreign aid on the welfare and wage inequality in a small open economy with tourism. Hazari and Sgro (1995) and Schubert (2009) adopt general equilibrium dynamic models, but they only consider a single commodity sector and hence cannot deal with the issue of the Dutch disease.

consumption or welfare will be left unchanged. This result suggests that openness to international financial markets is a possible way of relieving the impact of the Dutch disease.

Another feature of our analysis is that we consider a more general two-sector model. In their previous analysis, Chao et al. (2006) and Chang et al. (2011) both set up the specific-factor model in which the tourism (non-traded) good is produced using labor and another fixed input (say, land). A physical capital input is not used to produce the tourism good and is therefore fully allocated to the traded good sector. Such an assumption can significantly simplify the analysis and may be supported by an assessment based on observation. However, in some realistic cases capital investment is an essential factor in the production of tourism goods, including, for example, hotel devices, casinos, theme parks, and public transportation (domestic airplanes, trains and ships). Accordingly, in this paper we consider a general two-sector model in which both labor and capital inputs are required in the production of both traded and non-traded goods, and both inputs are allowed to be freely mobile between the traded and non-traded sectors. With this feature, we show that if the tourism good sector is labor-intensive, a tourism boom is welfare-reducing as proposed in the previous specific-factor studies. More interestingly, by contrast, if the tourism good sector is capital-intensive, a tourism boom is welfare-enhancing as it stimulates capital accumulation.

The remainder of this paper is organized as follows. In Section 2, we set up the basic structure of the two-sector dynamic general equilibrium model. In Section 3, we allow for international borrowings, and show that the negative impact of the Dutch disease can be mitigated. In Section 4, we examine how the relative factor intensity in the two sectors governs the welfare effects of the Dutch disease under a closed economy setting. In Section 5, numerical simulations are conducted to support our theoretical results. Lastly, concluding remarks are provided in Section 6.

2. The model

We consider an economy inhabited by a single infinitely-lived representative household, which derives utility from two types of consumption: the traded good C^X and the non-traded good C^Y.[3] The household's lifetime utility function is given by:

$$U = \int_0^\infty \frac{\left[\left(C^X\right)^\varepsilon\left(C^Y\right)^{1-\varepsilon}\right]^{1-\sigma}-1}{1-\sigma} e^{-\beta t} dt, \quad \sigma>0, \quad 1>\beta>0, \tag{1}$$

where the parameters ε and $1-\varepsilon$ are the utility weights attached to, respectively, the traded good and non-traded good, $\sigma>0$ is the inverse of the intertemporal elasticity of substitution in the consumption bundle, and β is the constant rate of time preference.

The representative household is endowed with one unit of labor, which is allocated to production between the traded good X with the portion of labor u $(0<u<1)$, and the non-traded good Y with the portion of labor $1-u$. It also accumulates physical capital K, and decides to allocate the current capital stock between the production of the traded good with the portion of physical capital sK $(0<s<1)$ and the non-traded good with the portion of physical capital $(1-s)K$. The production technologies of the two goods, $X(u,sK)$ and $Y((1-u),(1-s)K)$, are assumed to have diminishing marginal products, to be linearly homogeneous for both inputs, and to be subject to constant returns to scale. Hence, the production functions can be rewritten as

$$X = uf\left(k^X\right), \tag{2}$$

$$Y = (1-u)j\left(k^Y\right). \tag{3}$$

where $k^X \equiv sK/uL$ denotes the capital/labor ratio in the traded good sector and $k^Y \equiv (1-s)K/(1-u)L$ denotes the capital/labor ratio in the non-traded good sector. If $k^X>k^Y$, the traded good sector is (relatively) capital-intensive and the non-traded good sector is labor-intensive. If $k^X<k^Y$, the opposite applies.

In line with the previous literature on tourism (e.g., Chang et al., 2011, Chao et al., 2006, Copeland, 1991), we assume that, besides the domestic consumers, there are also foreign tourists in the economy, who by assumption only demand the non-traded good.[4] The demand function of the foreign tourists in relation to the non-traded good (or the tourism good) is:

$$D = D(p,T), \quad D_p<0, \quad D_T>0. \tag{4}$$

where the subscripts denote partial derivatives. p is the relative price of the non-traded to the traded good, and T is an exogenous parameter that captures the tourist activity. The market clearing condition for the non-traded good is:

$$Y = C^Y + D. \tag{5}$$

[3] Our model's structure is similar to previous two-sector models with traded and non-traded goods (see, e.g., Turnovsky, 1997a). It is well known that tourism leads to non-traded goods being transformed into traded and exportable goods. With this understanding, the major difference between Turnovsky and our paper is as follows. In the Turnovsky (1997a, Ch. 4) two-sector model, the non-traded goods are consumed only by domestic residents. However, in our paper, the non-traded goods are transformed into tourism goods, which are consumed by domestic residents and foreign tourists in the domestic country.

[4] Given that the foreign tourists can purchase the traded good in their home country and that the price of the traded good in both the domestic and foreign countries is the same, it seems reasonable to assume that they only consume the non-traded good in the domestic country.

We assume that the traded good X is used for consumption or investment, while the non-traded good Y is used only for consumption. Accordingly, the household's instantaneous budget constraint can be written as:

$$\dot{A} = X + pY + rA - rK - C^X - pC^Y, \tag{6}$$

where $A \equiv K - B$ denotes the net wealth, B denotes the stock of foreign debt and r denotes the interest rate. When international borrowings are allowed, we have $B > 0$; and when the economy is closed to the world capital market, we have $B = 0$.[5]

In the analysis that follows, we first examine the effects of a tourism expansion in the case with international borrowings, mainly because this is the relatively easy case to deal with. Then, we will move to shut down the possibility of international borrowings to highlight the importance of the role of factor-intensiveness.

3. Welfare effects of Dutch disease with international borrowings

In this section we study the effects of a tourism boom in a small open economy in the sense that the household can freely borrow from the world financial market. The household maximizes Eq. (1) subject to Eq. (6), which leads to the current-value Hamiltonian function

$$H = \frac{\left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{1-\sigma} - 1}{1-\sigma} + \varphi\left[uf\left(k^X\right) + p(1-u)j\left(k^Y\right) + rA - rK - C^X - pC^Y\right], \tag{7}$$

where φ is the shadow value of the net wealth A in terms of utility. Since we consider a small open economy, the interest rate must be pinned down by the world interest rate, denoted by $\bar{r}$, i.e., $r = \bar{r}$. The necessary optimality conditions with respect to the indicated variables are:

$$C^X : \left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{-\sigma} \varepsilon\left(C^X\right)^{\varepsilon-1}\left(C^Y\right)^{1-\varepsilon} = \varphi, \tag{8a}$$

$$C^Y : \left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{-\sigma} (1-\varepsilon)\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{-\varepsilon} = \varphi p, \tag{8b}$$

$$s : f'\left(k^X\right) = pj'\left(k^Y\right), \tag{8c}$$

$$u : f\left(k^X\right) - k^X f'\left(k^X\right) = p\left[j\left(k^Y\right) - k^Y j'\left(k^Y\right)\right], \tag{8d}$$

$$K : \varphi\left[sf'\left(k^X\right) + (1-s)pj'\left(k^Y\right) - \bar{r}\right] = 0, \tag{8e}$$

$$A : \varphi\bar{r} = -\dot{\varphi} + \beta\varphi, \tag{8f}$$

$$\varphi : \dot{A} = uf\left(k^X\right) + p(1-u)j\left(k^Y\right) - C^X - pC^Y + \bar{r}A - \bar{r}K, \tag{8g}$$

and the transversality condition is $\lim_{t\to\infty}\varphi A e^{-\beta t} = 0$.

The macroeconomic model contains Eqs. (8a)–(8g), the equilibrium condition for the capital input $uk^X + (1-u)k^Y = K$, and the equilibrium condition for the non-traded good $(1-u)j(k^Y) = C^Y + D(p,T)$. The nine equations jointly determine the nine unknowns C^X, C^Y, φ, A, K, p, k^X, k^Y and u.[6]

It can be easily derived from Eqs. (8c) and (8e) that the non-arbitrage condition between physical capital and foreign debt is $f'(k^X) = pj'(k^Y) = \bar{r}$, meaning that the return on physical capital (i.e., the marginal productivity of physical capital in both sectors) is equal to that on foreign debt. That is, we implicitly assume that domestic physical capital and foreign debt are perfectly substitutable assets.[7]

In line with the previous literature such as Obstfeld (1983); Djajic (1989), and Sen and Turnovsky (1989), the knife-edge condition $\beta = \bar{r}$ is assumed to hold so as to satisfy $\dot{\phi} = 0$. Thus, given this assumption, the model presented here actually has no transitory dynamics, and accordingly can be treated as a static model.[8] From Eqs. (8c) and (8d), we can solve for the capital/labor ratios in the two sectors in terms of the relative price, i.e., $k^X = k^X(p)$ and $k^Y = k^Y(p)$. By incorporating these conditions into the non-arbitrage condition $f'(k^X) = pj'(k^Y) = \bar{r}$, we can derive the relative price p in the function of the exogenous world interest rate:

$$p = \Psi(\bar{r}). \tag{9}$$

[5] Our result is robust to the case where the country is a creditor, that is, $B < 0$. See Turnovsky (1997a, p.25) for a discussion on this point.

[6] The endogenous variable s is then determined by the definition $k^X \equiv sK/u$.

[7] By introducing investment adjustment costs, Sen and Turnovsky (1989, 1990) show that both domestic physical capital and foreign debt become imperfectly substitutable assets. See Section 6.3.

[8] A detailed proof for the absence of transitory dynamics is available from the authors upon request.

The above equation shows an essential property of this model. The supply side alone determines the capital/labor ratios and the relative price. These three variables p, k^X, and k^Y are constant over time and, more importantly, independent of the demand shock caused by a tourism expansion, i.e., $p_T = 0$. Moreover, by total differentiation of Eq. (8g), using Eq. (9) and the static nature of the model, we can derive the condition $\varphi_T = 0$. The intuition is that although a tourism boom will change capital accumulation, with international borrowings, the change in the amount of capital is exactly offset by the change in the foreign debt. As a consequence, the amount of the total assets is unchanged and so is its relative shadow price φ.

We are now in a position to examine whether an expansion in tourism will lead to the Dutch disease and its welfare consequence. The most straightforward way to analyze this is to check Eqs. (8a) and (8b). These two equations determine the consumption levels C^X and C^Y in function of φ and p. Moreover, we have demonstrated above that φ and p are independent of T. This indicates that none of these two consumption variables will change in response to a change in T. Given that the household's utility is composed of consumption alone, we can thus directly infer that the tourism boom will not affect the level of social welfare.[9]

Finally, we discuss the emergence of the Dutch disease. In doing so, we differentiate the market clearing condition for the non-traded good (5) with respect to the tourism shock T, which gives $Y_T = C_T^Y + D_T$. Since C^Y is independent of T, we have the condition that $Y_T = D_T > 0$. Moreover, from Eqs. (2) and (3), it is easy to demonstrate that $X_T = -(f/j)Y_T < 0$. In other words, a tourism boom results in a shift in productive resources from the traded good sector to the non-traded good (tourism good) sector.

The following proposition summarizes the above discussions:

Proposition 1. *With international borrowings, a boom in tourism results in the Dutch disease, which, however, will not change the social welfare level.*

The main message from Proposition 1 is that openness to international financial markets could serve as a possible way of relieving the impact of the Dutch disease. In addition to the analysis above, we can also realize this result through the income side. Specifically, the aggregate domestic income can be defined as $w + \bar{r}A$, where $w \equiv f(k^X) - k^X f'(k^X)$ denotes the marginal product of labor (or the potential wage rate), which is independent of the tourism demand. With international borrowings, even though the level of capital stock may increase or decrease upon experiencing a tourism boom, its change is canceled out by the change in the stock of foreign debt. Accordingly, the total asset A stays intact so that the aggregate domestic income is also intact. With this unchanged domestic income, plus the fact indicated by Eq. (9) that the relative price is static, the household tends not to alter its consumption choices between the tourism and traded goods. As a consequence, the emergence of the Dutch disease has no effect on the level of social welfare.

4. Welfare effects of Dutch disease with relative factor-intensiveness

In this section, we do not allow for the possibility of international borrowings, that is, we ignore foreign debt such that $B = 0$ and $A = K$. We will show that when the economy cannot have access to the world financial market, the relative factor-intensity plays an important role in the welfare effects of the Dutch disease. By inserting $B = 0$ and denoting λ as the shadow value of capital in terms of utility, the current-value Hamiltonian function is written as

$$H = \frac{\left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{1-\sigma} - 1}{1-\sigma} + \lambda\left[uf\left(k^X\right) + p(1-u)j\left(k^Y\right) - C^X - pC^Y\right], \tag{10}$$

and the necessary optimality conditions with respect to the indicated variables are:

$$C^X : \left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{-\sigma} \varepsilon\left(C^X\right)^{\varepsilon-1}\left(C^Y\right)^{1-\varepsilon} = \lambda, \tag{11a}$$

$$C^Y : \left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{-\sigma} (1-\varepsilon)\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{-\varepsilon} = \lambda p, \tag{11b}$$

$$s : f'\left(k^X\right) = pj'\left(k^Y\right), \tag{11c}$$

$$u : f\left(k^X\right) - k^X f'\left(k^X\right) = p\left[j\left(k^Y\right) - k^Y j'\left(k^Y\right)\right], \tag{11d}$$

$$K : \lambda\left[sf'\left(k^X\right) + (1-s)pj'\left(k^Y\right)\right] = -\dot{\lambda} + \beta\lambda, \tag{11e}$$

[9] It should be noted that the welfare neutrality relies on two important assumptions. First, we have assumed a perfect international financial market, in which the country faces a constant world interest rate. Second, we have implicitly assumed that the tourism supply can adjust with perfect elasticity. In Section 6 we will relax these assumptions and discuss their implications. We thank an anonymous referee for bringing this point to our attention.

$$\lambda : \dot{K} = uf\left(k^X\right) + p(1-u)j\left(k^Y\right) - C^X - pC^Y, \tag{11f}$$

together with the transversality condition $\lim_{t\to\infty}\lambda K e^{-\beta t} = 0$. Eqs. (11a)–(11f), the equilibrium condition for capital input $uk^X + (1-u)k^Y = K$, and the equilibrium condition for the non-traded good ((5)) jointly determine the eight unknowns C^X, C^Y, λ, K, p, k^X, k^Y and u.

4.1. Dynamics

Unlike the model in Section 3, the model considered here involves transition dynamics. By some manipulations, the dynamic system in terms of λ and K can be derived from Eqs. (11e) and (11f) (notice that we have expressed p as a function of λ and K):

$$\dot{\lambda} = \lambda\left[\beta - f'\left(k^X(p)\right)\right], \tag{12}$$

$$\dot{K} = u(K,p)f\left(k^X(p)\right) - C^X(p,\lambda) + pD(p,T). \tag{13}$$

Let δ_1 and δ_2 be the two characteristic roots of the dynamic system. By using the above equations, we can derive (see Appendix A for a detailed derivation):

$$\Lambda \equiv \delta_1\delta_2 = \frac{j}{\Delta\sigma}\frac{C^Y}{\left(k^X-k^Y\right)^2}\left[\frac{\varepsilon}{1-\varepsilon}pj + f\right] < 0, \tag{14}$$

where $\Delta = D_p + C_p^Y - Y_p$\kern2pt<\kern2pt0. As is clear in Eqs. (12) and (13), the dynamic system has only one jump variable λ; moreover, from Eq. (14) we see that the system has one positive root. Therefore, the steady-state equilibrium is locally determinate and there exists a unique path converging to it.

Proposition 2. *The macro equilibrium under the tourism economy in the absence of international borrowings is unique and locally determinate.*

4.2. Steady state

We now turn to examine the consequences following an expansion in tourism. Of particular note, in this subsection we only focus on the effects in the steady state where all variables stay constant. The effects on the transition path will be examined through a numerical analysis in the next section.

Based on Eq. (12) and $\dot{\lambda} = 0$, we have $f'(k^X(p)) = \beta$. This indicates that, at the steady state, the relative price can be solved as the function of time preference only:

$$\tilde{p} = \Theta(\beta). \tag{15}$$

where a tilde denote the stationary values of any variables in the steady state. Eq. (15) reveals that an expansion in tourism has no long-run impact on the relative price, i.e., $\tilde{p}_T = 0$.[10] The intuition with regard to this result deserves detailed interpretation. In the short run, the expansion in tourism increases the demand for the tourism good and shifts the demand curve for the tourism goods rightwards. This leads to a rise in the relative price between the tourism and traded goods. With a higher price of the tourism good, more inputs of production are dedicated to the tourism sector, which also shifts the supply curve of the tourism goods rightwards. Due to the free mobility of both inputs (labor and physical capital) between the two sectors, the rightward shift in the demand curve is exactly offset by that of the supply curve.[11] As a result, the stationary value of the relative price between the tourism and traded goods remains constant in response to a boom in tourism. In fact, the result that demand shocks do not contribute to the long-run impact on the relative price, which is basically determined by the production side alone, is not peculiar in a general two-sector model (see Turnovsky, 1997a, Section 4.3).

To examine the long-run effect of a tourism expansion, we totally differentiate Eqs. (12) and (13) to obtain:

$$\begin{bmatrix} p_\lambda & p_K \\ -C_\lambda^X & u_K f \end{bmatrix}\begin{bmatrix} \tilde{\lambda}_T \\ \tilde{K}_T \end{bmatrix} = \begin{bmatrix} -p_T \\ -pD_T \end{bmatrix},$$

[10] It should be noted that equation (15) holds only for the steady state ($\dot{\lambda} = 0$). By contrast, equation (9) holds at any point in time.

[11] In previous specific factor models (e.g., Chang et al., 2011, Chao et al., 2006) in which capital is not mobile between the traded and non-traded sectors, the rightward shift of the supply curve is less than that of the demand curve. Therefore, in these models the stationary relative price is increased by an expansion in tourism.

and accordingly:

$$\tilde{\lambda}_T = \frac{\left(k^Y - k^X\right)(1-\varepsilon)j'pD_T}{[(1-\varepsilon)f + \varepsilon pj]C_\lambda^Y} \lesseqgtr 0 \quad \text{if} \quad k^X \lesseqgtr k^Y, \tag{16}$$

$$\tilde{K}_T = \frac{\left(k^Y - k^X\right)pD_T}{(1-\varepsilon)f + \varepsilon pj} \gtreqless 0 \quad \text{if} \quad k^X \lesseqgtr k^Y. \tag{17}$$

Proposition 3. *The steady-state level of physical capital is increased* (*decreased*) by a tourism boom if the tourism good sector is capital-intensive (labor-intensive).

The intuition underlying Proposition 3 is transparent. A tourism boom causes both labor and capital to move away from the traded good sector towards the tourism good sector. If the tourism good sector is capital-intensive, this process implies that more capital is being accumulated (relative to labor) so that the steady-state level of capital is increased.

We are now in a position to analyze whether the Dutch disease would emerge following an expansion in tourism, which can be seen by

$$\tilde{X}_T = -\frac{f}{(1-\varepsilon)f + \varepsilon pj}pD_T < 0, \tag{18}$$

$$\tilde{Y}_T = \frac{j}{(1-\varepsilon)f + \varepsilon pj}pD_T > 0. \tag{19}$$

It is clear that in association with a boom in tourism, the non-traded good (tourism good) sector expands and the traded good sector shrinks in response, which indicates the phenomenon of the Dutch disease.

We then proceed to investigate whether the Dutch disease is harmful to welfare. Given that in the steady state we have $\tilde{C}_X = \tilde{C}_X(\tilde{\lambda}, \tilde{p})$, $\tilde{C}_Y = \tilde{C}_Y(\tilde{\lambda}, \tilde{p})$, and $\tilde{p}_T = 0$, the change in both types of consumption in response to a tourism boom is determined solely by its impact on $\tilde{\lambda}$, that is:

$$\tilde{C}_T^X = C_\lambda^X \tilde{\lambda}_T = \frac{\left(k^Y - k^X\right)\varepsilon f'}{(1-\varepsilon)f + \varepsilon pj}pD_T \gtreqless 0 \quad \text{if} \quad k^X \lesseqgtr k^Y, \tag{20}$$

$$\tilde{C}_T^Y = C_\lambda^Y \tilde{\lambda}_T = \frac{\left(k^Y - k^X\right)(1-\varepsilon)j'}{(1-\varepsilon)f + \varepsilon pj}pD_T \gtreqless 0 \quad \text{if} \quad k^X \lesseqgtr k^Y. \tag{21}$$

Since the household's utility is positively related to two consumption goods, it is quite straightforward to demonstrate that the level of social welfare is enhanced (reduced) when the two consumption goods are increased (decreased). Thus, we can establish the following proposition:

Proposition 4. *In the absence of international borrowings, the Dutch disease following a tourism boom may either improve or reduce welfare. Specifically, if the tourism good sector is capital-intensive* (*labor-intensive*), *i.e.,* $k^X < k^Y (k^X > k^Y)$, *the Dutch disease improves* (*reduces*) the social welfare level.

Before explaining the intuition behind Proposition 4, it is helpful to first define $R = f'(k^X)$ as the marginal product of capital and $w = f(k^X) - k^X f'(k^X)$ as the marginal product of labor, and accordingly the domestic income in terms of the steady-state value can be expressed by the term $\tilde{R}\tilde{K} + \tilde{w}$.[12]

We now explain the intuition of Proposition 4 as follows. As indicated in Eq. (15), the relative price between the tourism and traded goods $\tilde{p}$ remains intact in the steady state. Since $\tilde{k}^X$ can be solved as a function of $\tilde{p}$, we can further infer that the factor returns $\tilde{R}$ and $\tilde{w}$ are also intact in the steady state. As a consequence, the change in domestic income is solely determined by the adjustment in the capital stock. Moreover, although the tourism boom is irrelevant to the steady-state price, during the adjustment period it will raise the relative price between the tourism and traded goods. Therefore, there is increased motivation to allocate more production resources to the tourism sector so as to produce more tourism goods, thereby leading to a reduction in the output level of the traded good $\tilde{X}$ and an increase in the output level of the tourism good $\tilde{Y}$. This consequence, known as the Dutch disease, can have diverse impacts on the capital stock with different cases of factor-intensiveness. In the case where $k^X < k^Y$, although both labor and capital are moving away from the traded good sector towards the tourism good sector, this process requires more capital (relative to labor) because the tourism good sector is capital-intensive (see Proposition 3). In other words, the

[12] The detailed derivation of total domestic income is relegated to the Appendix.

Table 1
Parameterization.

Parameters	Values	Parameters	Values
a	0.493/0.7	ξ^X	1
b	0.67	ξ^Y	1
σ	2	T_0	0.1
β	0.04	T_1	0.2
ε	0.3		

tourism boom results in an increase in the total capital stock in the case where $k^X < k^Y$. A larger capital stock implies a boom in total domestic income $\tilde{R}\tilde{K}+\tilde{w}$, and this wealth effect leads the household to increase its consumption of both the tourism and traded goods, thereby enhancing its welfare.

With similar intuition, under the situation where the tourism good sector is labor-intensive ($k^X > k^Y$) we can infer that a boom in the tourism good sector tends to decrease the capital stock, and hence is associated with a lower total domestic income. Therefore, the household is inclined to decrease its consumption of both the tourism and traded goods. This results in a fall in the welfare level.

5. Numerical analysis

In subsection 4.2 we find that a tourism boom may raise the welfare level even if it leads to the Dutch disease. It should be noted that this analytical result is only valid in the steady state because our analysis ignores the transitory dynamics and only compares the level of consumption and the value of the capital stock between steady states. In fact, during the transitional period, the household will adjust its consumption level for both goods to match the change in the capital stock, which in turn affects its welfare level. Thus, in this subsection we provide a simulation analysis to extensively examine the welfare effect of a tourism boom along the transitional path.

To implement a numerical analysis, it is convenient for us to specify an explicit form of the relevant behavior functions. For the production functions, we adopt the usual Cobb–Douglas form:

$$X(u, sK) = \xi^X (u)^a (sK)^{1-a} = \xi^X \left(k^X\right)^{1-a}, \tag{22}$$

$$Y((1-u),(1-s)K) = \xi^Y (1-u)^b [(1-s)K]^{1-b} = \xi^Y \left(k^Y\right)^{1-b}, \tag{23}$$

where ξ^X and ξ^Y are the productivity parameters. Furthermore, following Chao et al. (2006), the demand function for the tourism good on the part of foreign tourists is specified to take the simple form:

$$D = \frac{T}{p}. \tag{24}$$

We now turn to assign parameter values. Our objective here is not to provide a comprehensive quantitative evaluation but to check whether the analytical result in the steady-state is still tenable when the welfare responses along the transitional path are included. To this end, we simply adopt the values that are non-controversial in the literature. Table 1 lists our baseline parameter values. Some points deserve further comments. First, for simplicity, the productivity parameters of both types of goods in Eqs. (22) and (23) are normalized to unity, i.e., $\xi^X = \xi^Y = 1$. Moreover, following Atoliaa, Chatterjee, and Turnovsky (2012) the annual discount rate is set to $\beta = 0.04$. Second, the parameter representing the weight for both types of consumption in the utility function is set to $\varepsilon = 0.3$ based on the estimation in Lombardo and Ravenna (2014). Third, in line with the Lucas (1990) argument, we set $\sigma = 2$ to reflect that the intertemporal elasticity of substitution is equal to 0.5. Fourth, following Lombardo and Ravenna (2014), the parameter for the labor income share in the non-traded goods sector, b, is assumed to be 0.67. According to Lartey, Mandelman, and Acosta (2012), the ratio of tradable/non-tradable output is around 0.41 for 28 countries in Latin America and North America in 2003. We use this value to calibrate the parameter for the labor income share in the traded goods sector, a, to be 0.493. The resulting $(\tilde{k}^X, \tilde{k}^Y)$ is (172.42, 82.61), indicating that the tourism good sector is labor-intensive. To highlight the role of relative factor-intensity between the traded and tourism goods, we also consider an alternative value $a = 0.7$, such that the corresponding $(\tilde{k}^X, \tilde{k}^Y)$ is (17.786, 20.441), as an illustration of the case where the tourism good sector is capital-intensive. Fifth, the parameter capturing the tourists' demand for the nontraded (tourism) good T is initially set to 0.1, and increases to 0.2 to represent a tourism expansion.[13]

Our numerical results are displayed in Figs. 2–3.[14] Some observations emerge from the numerical analysis. First, in response to a tourism boom from $T_0 = 0.1$ to $T_1 = 0.2$, under the case where the tourism goods sector is labor-intensive, the production of the

[13] According to our baseline parameters, the values of the two roots δ_1 and δ_2 are $(-0.0057, 0.0527)$ in the case of $a = 0.4931$ and $(-0.0147, 0.0529)$ in the case of $a = 0.7$. This verifies convergence in our simulation model.

[14] To avoid a negative level of welfare, we have monotonically transferred the utility function by using the function form $U = \int_0^\infty \{\frac{[(C^X)^\varepsilon (C^Y)^{1-\varepsilon}]^{1-\sigma}-1}{1-\sigma} + 3\} e^{-\beta t} dt$.

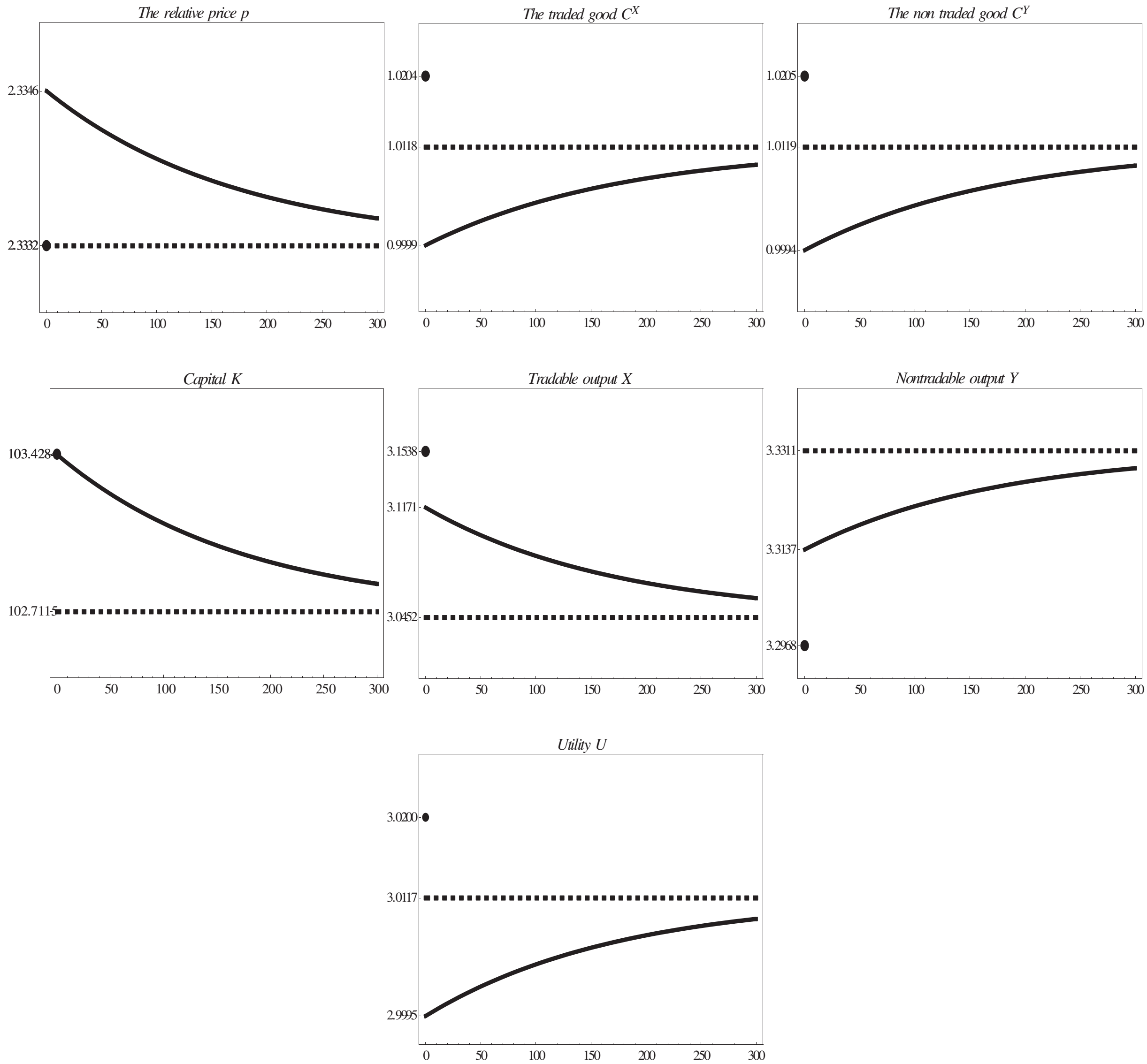

Fig. 2. Effects of a tourism boom when $k^X > k^Y$.

tourism goods tends to rise from 3.2968 to 3.3311 and the production of the traded goods tends to decline from 3.1538 to 3.0452. As a result, the Dutch disease is present. The same result applies in the case where the tourism goods sector is capital-intensive.

Second, for the case where the tourism goods sector is labor-intensive, following a tourism expansion the relative price between the tourism and traded goods rises from 2.3332 to 2.3346 on impact, and then gradually moves back to its initial value in the long run, as we have shown in Eq. (15). Under the case where the tourism good sector is capital-intensive, the relative price exhibits the same adjustment pattern.

Third, and more importantly, the impacts of tourism on consumption, capital, and welfare are diverse between two cases. Under the case where the tourism good sector is labor-intensive ($k^X > k^Y$), in response to a tourism boom:

(i) The consumption level of traded goods falls from 1.0204 to 0.9999 on impact, and then progressively rises to the steady-state value of 1.0118, which is lower than its initial value. In addition, the consumption level of tourism goods decreases from 1.0205 to 0.9994 on impact, and then progressively increases to the steady-state value of 1.0119, which is smaller than its initial value.

(ii) The stock of capital progressively decreases from its initial level of 103.4284 to a lower value of 102.7115.

(iii) The residents' utility falls from 3.02 to 2.9995 on impact, and then increases steadily toward its stationary value of 3.0117. As is exhibited in Fig. 2, in any time period along the whole of the transitional path, the residents' utility in association with

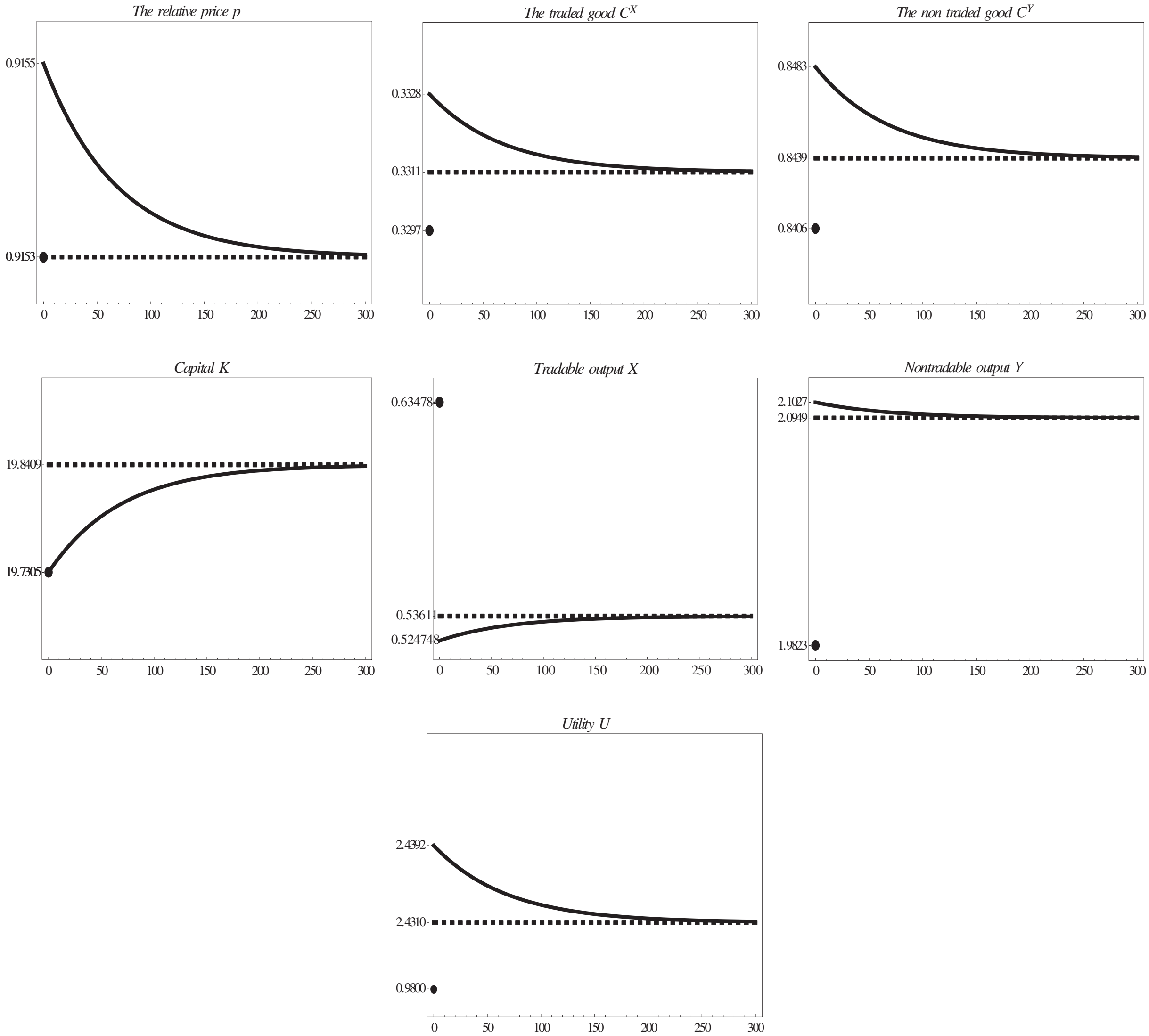

Fig. 3. Effects of a tourism boom when $k^X < k^Y$.

a tourism boom $T_1 = 0.2$ is less than its initial value of 3.02. As a result, the residents' welfare level (i.e., the sum of discounted utilities) is depressed.

Under the case where the tourism good sector is capital-intensive ($k^X < k^Y$), the above effects (i)–(iii) are exactly the opposite.

As is obvious, generally speaking, the numerical results are in line with our analytical results (Propositions 3 and 4). The relevant intuition is provided in the previous subsection, and thus we do not repeat it here.

6. Extensions

The welfare neutrality of the Dutch disease that we have shown in Proposition 1 relies on some simplified assumptions. In this section, we will relax them and examine whether the welfare neutrality result is still robust. Specifically, we conduct three extensions. The first extension is to take into account an imperfect international bond market; the second extension is to consider an endogenous choice of labor supply; and the last extension is the presence of investment adjustment costs. To obtain explicit analytical results, throughout this section we will use the Cobb–Douglas production functions reported in Eqs. (22) and (23).[15]

[15] To save space, in this section we will only present the relevant equations that are essential to obtain the main results. Interested readers are welcome to request detailed derivations from the authors.

6.1. Imperfect international bond market

In Section 3 we have considered a small open economy where the international bond market is perfect, such that the knife-edge condition requiring the world interest rate being equal to the rate of time preference always holds. In this subsection we relax this assumption by considering an imperfect international bond market.

In line with Turnovsky (1997b) and Weder (2001), the interest rate charged by the foreign country on debt is specified to be positively related to the debt–capital ratio:

$$r(B/K) = \psi_0 + \psi_1 \frac{B}{K}, \tag{25}$$

where ψ_0 is the exogenous component of the world interest rate and ψ_1 reflects the extent of borrowing premium associated with the default risk. We impose a parameter condition $\psi_0 + \psi_1 \geq \beta \geq \psi_0$ to ensure that the initial levels of B and K are non-negative. It is obvious that the world interest rate is a constant if $\psi_1 = 0$, and we are back to an economy with a perfect international bond market. However, the domestic economy no longer faces a constant world interest rate, but instead an upward-sloping curve for debt when borrowing from abroad if $\psi_1 > 0$. Furthermore, when the country borrows more (a higher B), the risk of default increases, and so will the costs of borrowing.

It should be noted that, unlike Section 3, the model with an imperfect international bond market has transitional dynamics, which can be expressed as:

$$\dot{\varphi} = \varphi\left(\beta - (1-a)\xi^X \left(k^X\right)^{-a}\right), \tag{26}$$

$$\dot{A} = \left(1 - \frac{\psi_1}{\psi_0 + \psi_1 - (1-a)\xi^X (k^X)^{-a}}\right)(1-a)\xi^X \left(k^X\right)^{-a} A + uf\left(k^X\right) - C^X + T. \tag{27}$$

After some tedious calculations, and defining $\tilde{W}$ as the level of steady-state welfare under an imperfect international bond market, we can derive the effect of a tourism boom on the social welfare level:

$$\tilde{W}_T = \left(\frac{(1-\varepsilon)}{\varepsilon \tilde{p}^{1+1/\sigma}}\right)^{(1-\varepsilon)(1-\sigma)} \frac{\Upsilon}{\tilde{p}\tilde{C}^Y} \frac{\varepsilon\left(\tilde{C}^X\right)^{-\sigma} \tilde{\varphi}^{1-1/\sigma}(\psi_0 + \psi_1 - \beta)\left(\tilde{k}^Y - \tilde{k}^X\right)}{(\psi_0 + \psi_1 - \beta)\xi^X \left(\tilde{k}^X\right)^{1-a} + (\beta - \psi_0)\tilde{p}\xi^Y \left(\tilde{k}^Y\right)^{1-b}}, \tag{28}$$

where $\Upsilon \equiv (\varepsilon^\varepsilon (1-\varepsilon)^{(1-\varepsilon)})^{(1-\sigma)/\sigma} > 0$ is a composite parameter.

It follows from Eq. (28) that, with an imperfect international bond market ($\psi_1 > 0$), the welfare neutrality of the Dutch disease does not hold. In particular, the Dutch disease will improve (worsen) social welfare if the tourism good sector is capital-intensive (labor-intensive). This result is qualitatively the same as that in Section 4 where international borrowings are not allowed. The underlying intuition is also similar. In short, a tourism boom leads resources to move to the tourism sector. When the international bond market is not perfect and the tourism sector is capital-intensive, more capital will be accumulated following a tourism boom. This implies an increase in total domestic life-time income in response, which correspondingly results in more consumption and higher welfare.

6.2. Endogenous labor supply

In the previous analysis we have assumed an inelastic labor supply. In this extension we take into account the household's labor–leisure choice. The lifetime utility function is then specified as:

$$U = \int_0^\infty \left\{ \frac{\left[\left(C^X\right)^\varepsilon \left(C^Y\right)^{1-\varepsilon}\right]^{1-\sigma} - 1}{1-\sigma} + \chi \ln(1-L) \right\} e^{-\beta t} dt, \tag{29}$$

where $\chi > 0$ determines the leisure preference, and $0 < L \leq 1$ is the labor supply. Maximizing Eq. (29) subject to Eq. (6) yields the optimal condition for the labor supply:

$$L = 1 - \frac{\chi}{\varphi\left[au\xi^X (k^X)^{1-a} + b(1-u)p\xi^Y (k^Y)^{1-b}\right]}. \tag{30}$$

After some manipulation with Eqs. (8c) and (8d), Eq. (30) can be simplified to $L = 1 - \chi/\varphi a \xi^X (k^X)^{1-a}$. As we have discussed earlier in Section 3, the knife-edge condition $\beta = \bar{r}$ implies that p, k^X and k^Y are independent of the demand shock caused by a tourism expansion. Following a similar approach in Section 3 we can also infer that $\varphi_T = 0$, which means that the levels of

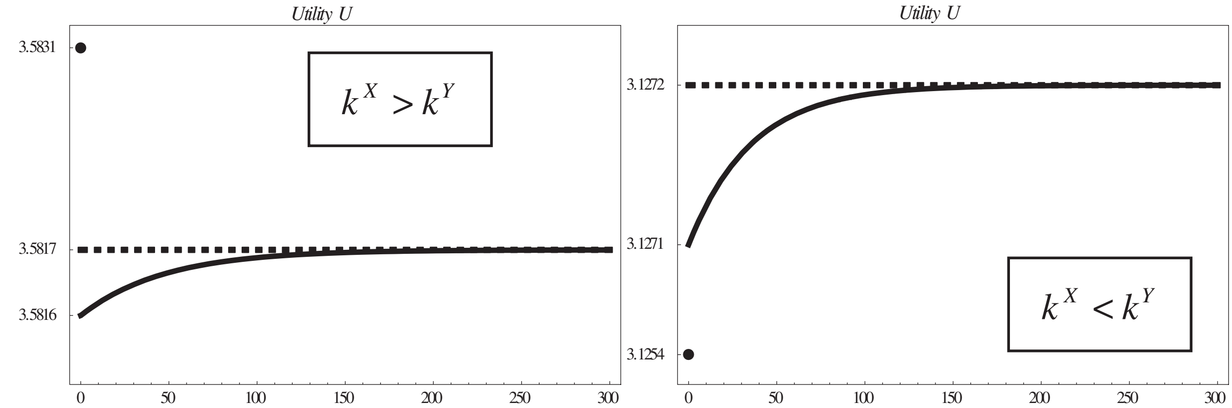

Fig. 4. Effects of a tourism boom with adjustment costs.

both kinds of consumption will not affected by the tourism shock. Because $\varphi_T = 0$ and $k_T^X = 0$, from Eq. (30) we can further infer that the total labor supply is independent of the tourism boom. As a consequence, the welfare neutrality of a tourism-driven Dutch disease still holds in the presence of an endogenous choice of labor supply. Intuitively, in the present two-sector small open economy, the factor allocations are only determined by the relative price that is pinned down by the (fixed) world interest rate and is independent of the demand shock. Given that the tourism boom cannot affect consumption and total supply, it will not affect welfare.

6.3. Investment adjustment costs

In our basic model, we have implicitly assumed that, as a tourism boom occurs, the supply of tourism goods can adjust perfectly. In reality, however, if the demand shock is strong, the supply side may not be perfectly elastic, at least in the short run. For example, new facilities have to be built to meet the large tourism expansion. To reflect this fact, in this extension we introduce investment adjustment costs to the model and reexamine the welfare neutrality.

The form of investment adjustment costs we consider is standard in the literature. The household's instantaneous budget constraint is modified as:

$$\dot{B} = C^X + pC^Y + I\left(1 + \frac{h}{2}\frac{I}{K}\right) + rB - (X + pY), \quad \dot{K} = I, \tag{31}$$

where I is investment and the term $hI/2K$ is the adjustment cost incurred by each unit of investment. The parameter h reflects the sensitivity of the adjustment costs.[16] If $h = 0$, there are no adjustment costs and Eq. (31) reduces to Eq. (6). The household maximizes Eq. (1) subject to Eq. (31), leading to the current-value Hamiltonian function:

$$H = \frac{\left[\left(C^X\right)^{\varepsilon}\left(C^Y\right)^{1-\varepsilon}\right]^{1-\sigma} - 1}{1-\sigma} + qI - \varphi\left[C^X + pC^Y + I\left(1 + \frac{h}{2}\frac{I}{K}\right) + rB - (X + pY)\right], \tag{32}$$

where q is the shadow price of investment.

To save space, we do not attempt to solve the model step by step. A numerical illustration, however, will be provided since analytical solutions are not available in this extended model. For the important parameter that captures the extent of the adjustment costs, we choose $h = 15$ by referring to Auerbach and Kotlikoff (1987). Moreover, by the same implementation as Section 5, the parameter for the labor income share in the traded goods sector, a, is calibrated to be 0.6012 in the case where the tourism good sector is labor-intensive and 0.7 in the case where the tourism good sector is capital-intensive. Other parameters are consistent with those in Section 5. The results in regard to the steady-state welfare effects of a tourism boom are shown in Fig. 4.

As is clear in Fig. 4, the welfare neutrality does not hold. The Dutch disease improves (worsens) the steady-state welfare level if the tourism good sector is capital-intensive (labor-intensive). The basic intuition can be explained as follows. With the presence of investment adjustment costs, physical capital and foreign debt are no longer perfectly substitutable assets. This implies that, as a tourism boom occurs, the household's net wealth (the sum of physical capital and foreign debt) will not remain unchanged, thereby resulting in a change in the household's lifetime income. This in turn leads the household to adjust its consumption on $C^X(\varphi,p)$ and $C^Y(\varphi,p)$. Given that the welfare level depends on $C^X(\varphi,p)$ and $C^Y(\varphi,p)$, the welfare effect of the tourism boom is

[16] The adjustment costs that depend upon investment relative to the capital stock can be justified by learning-by-doing in the installation process. As documented by Feichtinger et al. (2001, p. 255), "if the capital stock is large, a lot of machines have been installed in the past so that this firm has a lot of experience, implying that it is more efficient in installing new machines."

no longer neutral. If the tourism sector is capital-intensive, the rise in capital accumulation dominates the rise in foreign debt, causing an increase in the household's net wealth. This leads the household to have more consumption of both goods and a higher welfare level. By contrast, in response to a tourism boom, if the tourism sector is labor-intensive, the household tends to reduce its consumption of both goods, and hence have a lower welfare level

7. Conclusion

This paper sets out a general two-sector dynamic optimizing model for an open economy with tourism, and uses it to examine the possible consequence of a tourism boom on the possibility of the Dutch disease and social welfare. We contribute to the existing literature on tourism by introducing two novel elements that can play an important role in the welfare effects of the Dutch disease. The first is the possibility of international borrowings. We show that if the household can borrow freely from the international financial market, a tourism boom that leads to the Dutch disease will not affect the residents' welfare. The second element is that, by considering a general two-sector model rather than prior specific-factor models, we show that the relative factor-intensiveness between sectors can be relevant. When the economy is closed to the world financial market and the tourism goods sector is capital-intensive, the Dutch disease improves the level of social welfare.

A limitation of this study is that social externalities stemming from a tourism expansion are ignored to simplify the analysis. However, foreign tourists may bring both positive and negative externalities to domestic residents (see, e.g., Beladi et al., 2015; Chao et al., 2004), or production of tourism services can generate pollution emissions (Beladi, Chao, Hazari, and Laffargue, 2009). On the one hand, foreign visitors bring to local residents different cultures and lifestyles, which broaden the local residents' vision. On the other hand, huge numbers of tourists lead to congestion and environmental degradation. Based on these observations, it would be interesting to deal with whether our results are robust in the presence of social externalities. We leave this issue for future research.

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Appendix A

This Appendix provides a detailed derivation of Eq. (14). First of all, from Eqs. (11a)–(11f) we can derive the following equations

$$C^X = C^X(\lambda, p); \quad C^X_\lambda = -C^X/\sigma\lambda < 0, \quad C^X_p = (\sigma-1)(1-\varepsilon)C^X/\sigma p \gtrless 0,$$

$$C^Y = C^Y(\lambda, p); \quad C^Y_\lambda = -C^Y/\sigma\lambda < 0, \quad C^Y_p = -(1-\varepsilon+\varepsilon\sigma)C^Y/\sigma p < 0,$$

$$k^X = k^X(p); \quad k^X_p = j/\left(k^Y - k^X\right)f'',$$

$$k^Y = k^Y(p); \quad k^Y_p = f/pj''\left(k^Y - k^X\right),$$

$$p = p(\lambda, K; T); \quad p_\lambda = C^Y/\Delta\lambda\sigma < 0, \quad p_K = -ju_K/\Delta \gtrless 0, \quad p_T = -D_T/\Delta > 0$$

where $\Delta = D_p + C^Y_p - Y_p < 0$.

Let a tilde over the variables denote their stationary values in the steady state. Then, linearizing Eqs. (12) and (13) around the steady-state equilibrium yields:

$$\begin{bmatrix} \dot{\lambda} \\ \dot{K} \end{bmatrix} = \begin{bmatrix} \mu_{11} & \mu_{12} \\ \mu_{21} & \mu_{22} \end{bmatrix} \begin{bmatrix} \lambda - \tilde{\lambda} \\ K - \tilde{K} \end{bmatrix},$$

with

$$\mu_{11} = \frac{\partial \dot{\lambda}}{\partial \lambda} = -\lambda f'' k^X_p p_\lambda,$$

$$\mu_{12} = \frac{\partial \dot{\lambda}}{\partial K} = -\lambda f'' k^X_p p_K,$$

$$\mu_{21} = \frac{\partial \dot{K}}{\partial \lambda} = \left[u_p f + uf' k^X_p - C^X_p + pD_p + D\right]p_\lambda - C^X_\lambda,$$

$$\mu_{22} = \frac{\partial \dot{K}}{\partial K} = \left[u_p f + u f' k_p^X - C_p^X + pD_p + D\right] p_K + u_K f.$$

Finally, let δ_1 and δ_2 be the two characteristic roots of the dynamic system. By using the above equations, we can derive Eq. (14) in the main text.

Appendix B

In this appendix we show that total domestic income, defined as $X+pY$, can be alternatively represented by $RK+w$. First, since output in both sectors is produced according to the constant-returns-to-scale technology, we then have the relationships

$$X = X(u, sK) = \frac{\partial X}{\partial u} u + \frac{\partial X}{\partial sK} sK, \tag{A1}$$

$$Y = Y((1-s)K, (1-u)) = \frac{\partial Y}{\partial (1-u)} u + \frac{\partial X}{\partial (1-s)K}(1-s)K. \tag{A2}$$

By utilizing Eqs. (A1), (A2), (8c), and (8d) and performing some calculations, we obtain:

$$X + pY = \left(f - k^X f'\right) u + f' sK + p\left(\left(j - k^Y j'\right) u + j'(1-s)K\right). \tag{A3}$$

Finally, given that $R = f'(k^X)$ and $w = f(k^X) - k^X f'(k^X)$, Eq. (A3) can be rearranged as $X + pY = RK + w$.

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