Tourism, Dutch Disease and Welfare in an Open Dynamic Economy

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Abstract: This paper examines the effects of an expansion in tourism on capital accumulation, sectoral output and resident welfare in an open economy with an externality in the traded good sector. An expansion of tourism increases the relative price of the non-traded good, improves the tertiary terms of trade and hence yields a gain in revenue. However, this increase in the relative price of non-traded goods results in a lowering of the demand for capital used in the traded sector. The subsequent de-industrialization in the traded good sector may lower resident welfare. This result is supported by numerical simulations.

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1. Introduction

International tourism contributes significantly to the growth of national income, employment, and to earnings of foreign exchange in many developing and industrialized economies.[1] Tourism consists of consumption of non-traded and traded goods by non-local residents; it has been regarded as a major source of economic growth for certain economies. As aptly pointed by Luzzi and Flcukiger (2004), tourism is the consumption of a bundle of goods and services with unique destination features. In addition, as noted by Hazari and Sgro (2004), a notable feature of tourism is the transformation of non-traded goods and service into tradables via visits of foreign tourists. It is different from mobility of goods and factors. Despite the rapidly growing volume and spending of tourism in the last two decades, the analysis of the effects of the expansion of tourism, both as a source of export income in the short run and as an engine of growth in the long run, has not received enough attention in the trade and development literature.[2] This is somewhat surprising especially in view of the public policies adopted by numerous countries in promoting tourism to facilitate economic growth (Luzzi and Flcukiger, 2003).[3]

Among the few notable studies on the effects of tourism, Copeland (1991) indicates that tourists consume mainly local amenities and non-traded goods, like heritage and culture, nightlife and restaurant meals, and shopping opportunities. A tourist boom tends to raise the demand for and hence the prices of these non-traded goods (i.e., improvements of the so called secondary terms of trade), expanding their production at the expense of the traded sectors and, in particular, the manufacturing sector. This suggests that the tourist boom may lead to de-industrialization. Under full employment and perfect competition, the resulting sectoral output loss and gain offset each other, but tourism can still be beneficial via the terms-of-trade improvements. Copeland argues that, in the static model, an increase in tourism may create more benefits, if distortions are absent from the economy. Hazari and Sgro (1995) consider tourism and growth in a one-good,

dynamic model. They show that while an increase in tourism lowers domestic capital accumulation, it raises domestic consumption and welfare. However, due to the one-good economy setting, the resource-reallocation effect of tourism is not examined by Hazari and Sgro. Recently, Nowak, Sahli and Sgro (2003), demonstrate that using a three-sector general equilibrium framework, increased tourism can result in a fall in manufacturing output and welfare. Echoing this analysis, Hazari et al. (2003) examine the effects of tourism expansion in a four-goods, generalized Harris-Todaro economy. They argue that urban tourism always improves urban welfare, while its effect on rural welfare is indeterminate. In contrast, rural tourism necessarily raises both rural and economy-wide welfare; so there is no regional conflict.

The purpose of this paper is to make a contribution to the emerging literature by considering the effects of tourism in a dynamic specific factor model with capital accumulation. Domestic residents consume two goods, a traded good and a non-traded good, while tourists consume only the non-traded good.[4] Domestic residents also invest in domestic capital. The two goods are produced in the economy using labour, capital or land as inputs. An expansion of tourism increases the relative price of non-tradable goods, which leads to a gain in income via the secondary terms-of-trade effect.. However, this price effect results in a decrease in the demand for capital and therefore a reduction of output of the traded goods sector. We show that the phenomenon of the "Dutch Disease" regarding de-industrialization may be induced by a tourism boom.[5] Furthermore, the decline of the capital stock may cause a welfare loss in the long run.

This paper is organized in the following manner. Section 2 sets up a general-equilibrium dynamic model for an open economy with tourism. The effects of tourism on capital accumulation, sectoral output and domestic welfare are examined in section 3. Section 4 provides a simulation of the model. In section 5 conclusions are stated.

2. The Model

Consider an open economy that produces two goods, a traded good, X, and a non-traded good Y. The production functions are $X = g(\overline{K})G(L_X, K)$ and $Y = Y(L_Y, V)$, where L_i, K and V represent the allocation of labour, capital and land to sectors X and Y,[6] and $\overline{K}$ denotes the aggregate capital in the home economy and the function g captures the externality. It is assumed that $g' > 0$, and therefore there are increasing returns to sector X. The production structure of this model can be represented by the revenue function: $R(p_X g, p_Y, K) = \max \{p_X g X(L_X, K) + p_Y Y(L_Y, V): L_X + L_Y = L\}$, where L is the labor endowment of the economy.[7] Choosing the traded good X as the numeraire, the relative price of good Y is denoted by p and the revenue function is expressed by $R(g, p, K)$. Denoting subscripts as partial derivatives, from Hotelling's lemma we have: $R_p (= \partial R/\partial p) = Y$, the output of good Y, with $R_{pp} > 0$. Note that $R_g (= \partial R/\partial g) = G(L_X, K)$, where L_X is evaluated at its optimal level. In addition, letting r be the rate of return to capital, we have: $R_K = r$, with $R_{KK} < 0$. Furthermore, $R_{gK} > 0$ and $R_{pK} < 0$, as a rise in K increases the production of good X at the expense of good Y. Note that K and V are specific factors.

We assume that there are two types of consumers in the economy: domestic residents and foreign tourists. Domestic residents consume both goods and their consumption is denoted by C_X and C_Y. However, foreign tourists by assumption only demand the non-traded good, denoted by D_Y, and their demand function is denoted by $D_Y(p, T)$, where T represents a shift parameter for capturing the tourist activity, and it is assumed that $\partial D_Y/\partial T > 0$. The market-clearing condition for the non-traded good in the economy is:

$$C_Y + D_Y(p, T) = R_p(g, p, K), \tag{1}$$

where recalling that R_p denotes the domestic supply of good Y. The relative price p of good Y is thus endogenously determined by equation (1).

The domestic residents consume both goods X and Y, and also save to invest in capital. The capital accumulation equation is given below:[8]

$$\dot{K} = R(g, p, K) - C_X - pC_Y, \tag{2}$$

where a dot over a variable represents its time derivative.

The domestic residents maximize the present value of their instantaneous utility, $U(\times)$, subject to the constraint denoted by equation (2). The intertemporal welfare function W is:

$$W = \int_0^\infty U(C_X, C_Y)e^{-rt}dt, \tag{3}$$

where r denotes the rate of time preference. The first-order conditions with respect to C_X and C_Y are given by:

$$U_X(C_X, C_Y) = \mathit{l}, \tag{4}$$

$$U_Y(C_X, C_Y) = \mathit{l}\, p, \tag{5}$$

where l denotes the shadow price of domestic capital. In addition, the dynamics of the shadow price l are determined by

$$\dot{\mathit{l}} = \mathit{l}[r - R_K(g, p, K)]. \tag{6}$$

To rule out non-optimal solutions in the neighborhood of a steady-state equilibrium, the following transversality condition is also assumed to be satisfied:

$$\lim_{t \to \yen} \mathit{l}\, Ke^{-rt} = 0. \tag{7}$$

This completes the specification of the model.

3. The Results

We now proceed to examine the effects of an expansion of tourism on capital accumulation, sectoral output and domestic welfare for the economy. We first analyze the equilibrium condition in the short-run and then the dynamic equilibrium.

a. Temporary equilibrium

In a temporary or short-run equilibrium, the initial amount of domestic capital is given by K_0 and its shadow price is l.. For a given value of the shift parameter T, the system can be solved

for p, C_X and C_Y using equations (1), (4) and (5) as functions of K, l and T. From this we know

that $p = p(K, l, T)$, $C_X = C_X(K, l, T)$ and $C_Y = C_Y(K, l, T)$. We have the following lemma:

Lemma. In the short run, increases in capital or tourism will result in higher prices of the

nontradable good, but the increases will reduce the consumption of both goods.

The reasons are as follows. An increase in capital, K, lowers the supply of good Y and

therefore raises its price ($\partial p/\partial K > 0$). This reduces the demand for good Y by domestic residents

($\partial C_Y/\partial K < 0$). On the other hand, for $U_{XY} > 0$, the decreased consumption of good Y lowers

marginal utility of good X, thereby reducing the demand for good X ($\partial C_X/\partial K < 0$). Analogously,

a rise in the shadow price of capital lowers the demand for both goods in consumption ($\partial C_X/\partial l <$

0 and $\partial C_Y/\partial l < 0$) and hence the non-tradable price ($\partial p/\partial l < 0$). In addition, a rise in tourism

increases the demand for the non-tradable good and hence its price ($\partial p/\partial T > 0$). This increase

causes the demand for both goods by domestic residents to fall ($\partial C_X/\partial T < 0$ and $\partial C_Y/\partial T < 0$).[9]

b. Dynamics

The above short-run conditions are now used to characterize the local dynamics of the model.

First, from equation (2), the dynamics of domestic capital accumulation are:

$$\dot{K} = R[g(K), p(l, K, T), K] - C_X(l, K, T) - p(l, K, T)C_Y(l, K, T), \tag{8}$$

and, in equilibrium, total expenditure by domestic residents is equal to revenue from domestic

product. Second, from equation (6), the movements of the shadow price of domestic capital are:

$$\dot{l} = l\{r - R_K[g(K), p(l, K, T), K]\}. \tag{9}$$

If $\dot{l} = 0$, then the value of the marginal product of capital equals the rate of time preference.

The equilibrium dynamics of K and l in equations (8) and (9) are described by their

linear approximations around the steady-state values, as follows:[10]

$$\begin{bmatrix} \dot{K} \\ \dot{l} \end{bmatrix} = \begin{bmatrix} R_K + R_g g' + D_Y(\partial p/\partial K) - \partial C/\partial K & D_Y(\partial p/\partial l) - \partial C/\partial l \\ -l(R_{KK} + R_{gK}g' + R_{pK}(\partial p/\partial K)) & -lR_{pK}(\partial p/\partial l) \end{bmatrix} \begin{bmatrix} K - \tilde{K} \\ l - \tilde{l} \end{bmatrix} \tag{10}$$

A tilde ($\sim$) over a variable denotes its steady-state level. The determinant of the above coefficient matrix of the two differential equations is:

$$\det = -\mathbf{l}\{R_{pK}[(R_K + R_g g')(\partial p/\partial \mathbf{l}) - (\partial p/\partial \mathbf{l})(\partial C/\partial K) + (\partial p/\partial K)(\partial C/\partial \mathbf{l})]$$

$$+ (R_{KK} + R_{gK}g')[\partial C/\partial \mathbf{l} - D_Y(\partial p/\partial \mathbf{l})]\},$$

which is negative if $R_{KK} + R_{gK}g' < 0$ and $\mathbf{l} - D_Y(U_{XY} - pU_{XX}) > 0$.[11] Note that because $R_{KK} + R_{gK}g' < 0$, the condition on diminishing returns on capital still holds although there is an externality in sector X. In this case, the steady-state equilibrium is a saddle point with one negative and one positive eigenvalue. In Figure 1, we depict the saddle-point stability condition in the $(K, \mathbf{l})$ space. The arrows indicate the movements towards the equilibrium point E. While the capital stock always evolves gradually, however, its shadow price $\mathbf{l}$ may jump in response to external shocks.
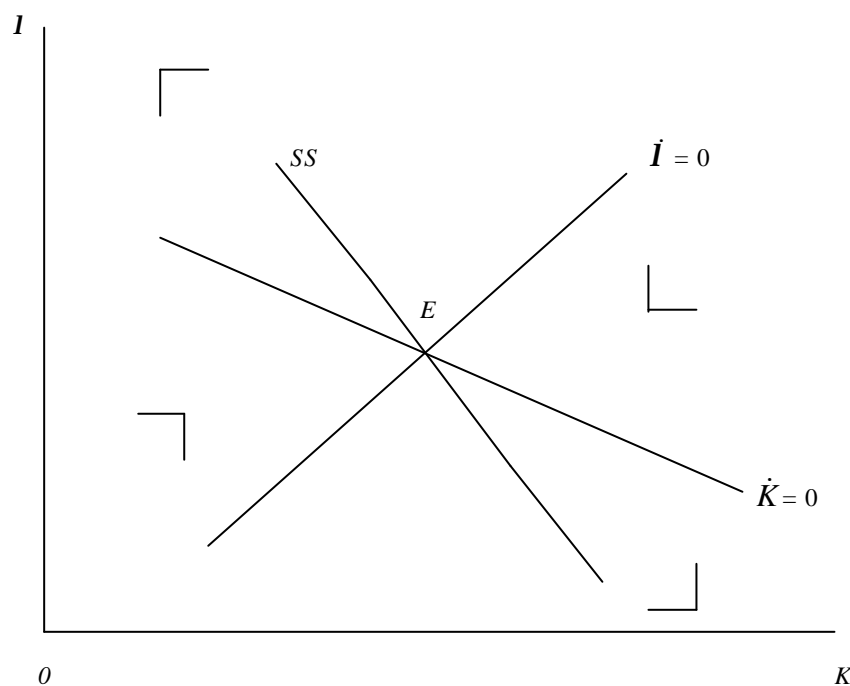

Figure 1. Saddle-point stability

For the given initial value of the capital stock, K_0, we can obtain from (10) the following solutions for the capital stock and its shadow price around their steady-state values:

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$$K_t = \tilde{K} + (K_0 - \tilde{K})e^{mt}, \tag{11}$$

$$l_t = \tilde{l} + q(K_t - \tilde{K}), \tag{12}$$

where $q = \{m - [R_K + R_g g' + D_Y(\partial p/\partial K) - (\partial C/\partial K)]\}/[D_Y(\partial p/\partial l) - \partial C/\partial l] < 0$, and $m(< 0)$ is the negative eigenvalue in (10). Equation (12) represents the stable arm of the relation between K and l, depicted by the SS schedule in Figure 1. The negative sloped stable arm indicates that a decrease in K leads to an increase in its shadow price l, and vice versa.

c. Steady State

The steady-state equilibrium is characterized by equations (1), (4) and (5), with $\dot{K} = 0$ in equation (2) and $\dot{l} = 0$ in equation (6), as:

$$R(g, \tilde{p}, \tilde{K}) - \tilde{C}_X - \tilde{p}\,\tilde{C}_Y = 0, \tag{13}$$

$$R_K(g, \tilde{p}, \tilde{K}) = r. \tag{14}$$

Equations (1), (4), (5), (13) and (14) contain five endogenous variables, $\tilde{p}, \tilde{C}_X, \tilde{C}_Y, \tilde{K}$ and $\tilde{l}$, and a shift parameter, T. This system determines the impacts of tourism in steady state. In particular, an increase in tourism on the steady-state price of the non-tradable good is:

$$d\tilde{p}/dT = -(R_{KK} + R_{gK}g')(\partial D_Y/\partial T)(2pU_{XY} - p^2 U_{XX} - U_{YY})/\Delta > 0, \tag{15}$$

where $U_{XX} < 0$, $U_{YY} < 0$, $R_{KK} + R_{gK}g' < 0$ and $\Delta > 0$.[12] That is, an increase in the tourism exports will lead to an improvement in the terms of trade. Nonetheless, the presence of the capital-generating externality ($g' > 0$) weakens the quantitative effect of an improvement in the terms of trade. This can be explained from the change in the capital stock. From equation (14), the effect of tourism on domestic capital in steady state is:

$$d\tilde{K}/dT = -[R_{pK}/(R_{KK} + R_{Kg}g')](d\tilde{p}/dT) < 0, \tag{16}$$

where recalling that $R_{pK} < 0$ and $R_{KK} < 0$. Hence, a rise in tourism reduces the stock of domestic capital. This reduction of capital further lowers the supply of the tradable good through the capital

externality in sector X, thereby giving rise to an effect that mitigates the increase in the non-tradable price as indicated by g' in equation (15).

The change in domestic capital in equation (16) is illustrated in Figure 2. An increase in T shifts both the schedules of $\dot{I} = 0$ and $\dot{K} = 0$ to the left, yielding a new steady-state equilibrium at point E' and a corresponding stable arm S'S'. The adjustment can be decomposed into two steps: initially for a given stock of domestic capital ($K_0 = \tilde{K}$), the rise in T increases p at time 0,[13] lowering I initially to point F.[14] Consequently, the fall in I reduces K, moving I upward along the path S'S' to point E'.[15]
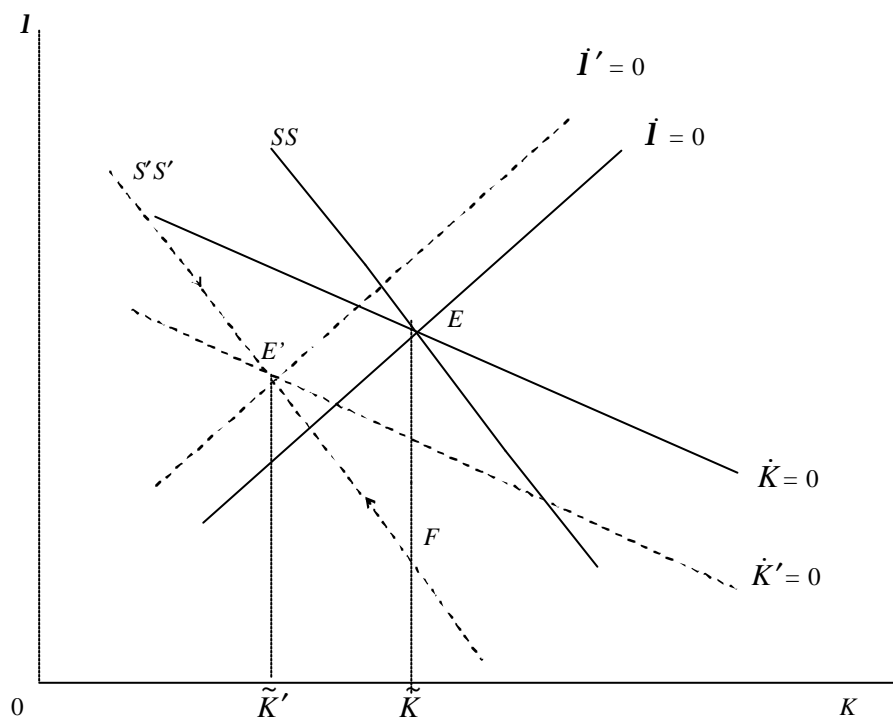

Figure 2. An expansion of tourism and its effect on equilibrium

Consider next to the effect of tourism on sectoral outputs in the steady state. Because $X = g(K)R_g(g, p, K)$ and $Y = R_p(g, p, K)$, we have

$$d\tilde{X}/dT = gR_{gp}(d\tilde{p}/dT) + (gR_{gK} + R_g g')(d\tilde{K}/dT) < 0, \qquad (17)$$

$$d\tilde{Y}/dT = R_{pp}(d\tilde{p}/dT) + (R_{pK} + R_{pg}g')(d\tilde{K}/dT) > 0, \qquad (18)$$

where $R_{gp} < 0$, $R_{pp} > 0$, $R_{gK} > 0$ and $R_{pK} < 0$. An increase in tourism activity expands the tourism-related sector at the expanse of the manufacturing sector, and the decline in the manufacturing sector is magnified by the reduction in domestic capital. Thus, an expansion of tourism may bring about the "Dutch Disease" in terms of de-industrialization in the economy. This Dutch Disease is demand induced working via the change in the stock of capital.

We now turn to address the following important question: what is the effect of tourism on welfare of the economy? Following Turnovsky (1999, p. 138), we denote $Z = U(C_X, C_Y)$ and the adjustment path of Z is: $Z_t = \tilde{Z} + [Z(0) - \tilde{Z}]e^{mt}$, where $Z(0)$ denotes the utility at time 0. From equation (3), we can obtain total welfare as: $W = \tilde{Z}/r^* + [Z(0) - \tilde{Z}]/(r^* - m)$, and therefore the change of welfare is: $dW/dT = [dZ(0)/dT - (m/r)(d\tilde{Z}/dT)]/(r - m)$, where $-m/r$ (> 0) represents the discount factor.[16] Utilizing equation (13), we can express the change of welfare as

$$dW/dT = [1/(r - m)]\{D_Y[dp(0)/dT - (m/r)(d\tilde{p}/dT)] - (m/r)(R_K + R_g g')(d\tilde{K}/dT)\}. \qquad (19)$$

where $dp(0)/dT > 0$, the change of the price of good Y at time 0. An expansion of tourism raises the initial and steady-state prices of good Y, improving the terms of trade; but the effect is reduced by the capital externality [as shown in equation (15)]. Nonetheless, the terms-of-trade improvement yields a larger income as shown in the first term in the curly bracket in equation (19). However, the higher relative price of good Y lowers the production of good X, resulting in a smaller demand for capital. This leads to a de-industrialization effect, and this effect is magnified by the presence of the externality. A welfare loss corresponding to the reduction in the capital stock is indicated in the second term of equation (19). Due to these two conflicting effects, the welfare effect of tourism expansion in equation (19) is ambiguous. Nevertheless, when $m = 0$ and $r = 1$, then in the static model under consideration we have: $dW/dT = 1D_Y(dp/dT) > 0$; that is, an

expansion of the tourism sector always improves welfare via the terms-of-trade effect. However, in a dynamic model, the de-industrialization effect caused by the decrease in capital may weaken the positive term-of-trade effect on tourism. Specifically, setting $\boldsymbol{n} = - (\boldsymbol{m}\boldsymbol{r})(d\tilde{p}/d\boldsymbol{a})/[dp(0)/dT - (\boldsymbol{m}\boldsymbol{r})(d\tilde{p}/dT)]$ and letting $\boldsymbol{e}_{rK}$ denote the price elasticity of demand for capital and $\boldsymbol{e}_{KY}$ be the output elasticity to capital in sector Y,[17] then we have $dW/dT < 0$ if $D_Y/Y < \boldsymbol{n}\boldsymbol{e}_{rK}\boldsymbol{e}_{KY}$. An expansion of tourism raises the steady-state price of good Y relative to the all-period prices by the ratio of $\boldsymbol{n}$. This gives a downward pressure to the rate of return on capital, thereby reducing the demand for capital (measured by $\boldsymbol{e}_{rK}$) and hence less output of good X (captured by $\boldsymbol{e}_{KY}$).[18] This suggests that the larger the degrees of $\boldsymbol{e}_{rK}$ and $\boldsymbol{e}_{KY}$, the more the likely that $dW/dT < 0$. Note that the capital externality g' is captured by the $\boldsymbol{e}_{rK}$ term: the bigger the g', the larger the $\boldsymbol{e}_{rK}$ is. We summarize the above results as follows:

Proposition: For an open economy, an expansion of tourism raises the prices of the non-tradable good, yielding a gain from the terms-of-trade improvement. However, tourism causes de-industrialization by reductions in domestic capital and hence manufacturing output. Therefore, tourism may lower welfare if the loss from de-industrialization is larger than the gain from the terms-of-trade improvement. In the presence of the capital externality in the traded sector, immiserizing tourism boom is more likely to occur as the externality reduces the terms-of-trade improvement and worsens the de-industrialization effect.

4. Simulations for the Effects of Tourism

In this section, we specify functional forms for the utility and production functions to calibrate the effects of an increase in tourism on the endogenous variables of the economy, with a particular reference to changes in total welfare. Assuming Cobb-Douglas functions for the production of the traded and non-traded goods:

$$X = Ag(K_{-1})L_X^{\boldsymbol{a}} K_{-1}^{1-\boldsymbol{a}}, \tag{20}$$

$$Y = B(L - L_X)^b, \tag{21}$$

where A and B are constant technology factors, a and b are the labour shares in sectors X and Y, and $g(K_{-1}) = K_{-1}^d$ captures the capital-generating externality in sector X. Note that K_{-1} denotes the last-period capital stock, and the specific factor V in sector Y has been normalized to unity. The equilibrium allocation of labour between the two sectors gives:

$$aA\,K_{-1}^d\,(K_{-1}/L_X)^{1-a} = bpB(L - L_X)^{b-1}. \tag{22}$$

We assume a CES functional form for the current utility function of households:

$$U(C_X, C_Y) = [b^{1/(1+s)}\,C_X^{s/(1+s)} + \overline{b}^{\,1/(1+s)}\,C_Y^{s/(1+s)}]^{(1+1/s)(1-g)}/(1 - g), \tag{23}$$

where $1 + s \geq 0$ is the elasticity of substitution between the two goods. In addition, let $g \geq 0$ be the index of relative risk aversion, with the risk neutrality case occurring with $g = 0$. Note that b is a parameter, where $b \in [0, 1]$ and $\overline{b} = 1 - b$. The utility is maximised subject to the budget constraint: $C_X + pC_Y = I$, where I denotes the expenditure on consumption. This gives the relative demand between the two goods:

$$bC_Y/\overline{b}\,C_X = p^{-(1+s)}. \tag{24}$$

Substituting (24) into the utility function (23) yields: $U(C_X, C_Y) = [C_X(b + \overline{b}\,p^{-s})^{1+1/s}/b]^{1-g}/(1 - g)$. The intertemporal utility function for the consumers is therefore: $W = \Sigma_t(1 - r)^t[C_X(b + \overline{b}\,p^{-s})^{1+1/s}/b]^{1-g}/(1 - g)$, where r is the discount rate with $0 < r < 1$. This function is maximised with respect to K and C_X in each period under the budget constraint: $K - K_{-1} + C_X + pC_Y = X + pY$, which can be written as

$$K - K_{-1} + C_X(b + \overline{b}\,p^{-s})/b = A\,K_{-1}^d\,L_X^a\,K_{-1}^{1-a} + B(L - L_X)^b. \tag{25}$$

From the above constrained maximization, we obtain: $(1 - r)^t\,C_X^{-g}(b + \overline{b}\,p^{-s})^{(1+1/s)(1-g)-1} = l$ and $l - l_{+1}[1 + (1 - a)AK^d\,L_{X,+1}^a\,K^{-a}] = 0$, where l is the associated Lagrange multiplier.[19] Eliminating l and l_{+1}, we obtain:

$$(1 - a)X_{+1}/K = -1 + (1 - r)^{-1}(C_X/C_{X,+1})^{-g}[(b + \overline{b}\,p^{-s})/(b + \overline{b}\,p_{+1}^{-s})]^{(1+1/s)(1-g)-1}. \qquad (26)$$

Finally, the market-clearing condition for the non-traded good Y requires:

$$C_Y + D_Y = Y, \qquad (27)$$

where the demand for the non-traded good by tourists is:

$$D_Y = T/p. \qquad (28)$$

Equations (20) – (28) consist of nine endogenous variables, X, Y, L_X, U, C_X, C_Y, K, p and D_Y, and an exogenous variable for tourist spending T. There is one predetermined variable in the system: the capital stock, the initial value of which is K_0. The two anticipated variables are X and p with the final values: X_∞ and p_∞, which are equal to the final steady state values of the production of the traded good and the price of non-traded good. Infinity is approximated by a large number of periods, where the choice of this number will depend on the eigenvalues of the model. As we shall compute the sum of discounted utilities from time 0 to infinity, we must approximate infinity by a date such that the discounted utility at this date is very low (for instance, less than 1/100000 of the value of utility at time 0). Setting the number of simulation periods to 250 will be sufficient. In steady state, we have: $K_{-1} = K$, $X_{+1} = X$, $C_{X,+1} = C_X$ and $p_{+1} = p$.

a. Calibrations

We are now in a position to calibrate the system in the reference steady state. We use the German data as an illustration, and choose $p = 0.9488$, $X + pY = 1.3909$ and $L = 27.270$, which are the averages values of these variables for the period 1996 to 2002. The units are in trillion of 1995 euros and in millions of persons. We set: $T = 0$, $r = 0.05$, $a = 0.75$, $b = 0.70$, $b = 1/3$, $s = -0.5$, $g = 0.5$ and $d = 0$. So, we assume that there is no externality in the production of the tradable good for our reference calibration. The variables can be computed recursively: $X = (X + pY)/[1 + (\overline{b}/b)p^{-s}]$, $Y = (X + pY - X)/p$, $C_Y = Y$, $C_X = X$, $L_X = aL/(aX + bpY)$, $K = (1 - a)X(1 - r)/r$, $A = X/K^d L_X^a K^{1-a}$, $B = Y/(L - L_X)^b$, and U from (23). We obtain: $K = 2.241$, $X = 0.472$, $Y = 0.969$ and $L_X = 9.676$. We then check the existence and uniqueness of the solution, which require that one of

the eigenvalues must be less than 1 and the other larger than 1. The eigenvalues in the neighbourhood of the reference steady state are : 0.886 and 1.188. Therefore, the local condition of existence and uniqueness is satisfied. For the purpose of comparing the consequences of tourism in the short and in the long run, we simulated the model over 250 periods.

Turn next to reference simulations.[20] The spending by tourism T was increased from 0 to 0.01 (which means by 10 billions euros, the German value-added in non-tradable goods being 982 billions euros). We obtain the short- and long-run impacts of tourism in Figure 3:

1. C_X immediately increases above its reference value, then progressively decreases but stays above its reference value. C_Y immediately increases above its reference value, then progressively decreases and converges to a level lower than its reference value.

2. K progressively decreases to a depressed level.

3. p immediately increases above its reference value, then progressively decreases but stays above its reference value. As tourists spending are fixed in "tradable goods", D_Y increases as p decreases.

4. X immediately decreases, then increases progressively and converges to a level lower than its reference value. L_X has the same evolution. Y immediately increases, then decreases progressively and converges to a level higher than its reference value.

5. U immediately increases above its reference value, then progressively decreases and reaches in the long run a value under its reference value. The overall welfare W of the country is the sum of the discounted U. The reference value of W is $RW = 48.005021$. The shock increases W to $SW = 48.005600$, that is, by 0.000579. Note that tourism increases the overall welfare of residents in the short and medium term, but the welfare is declining in the long run. This last result is connected to the lower level of capital in the long run. In the reference simulation with no externality in the production of good X, the benefits in the short and the medium run are higher than the loss in the long run.
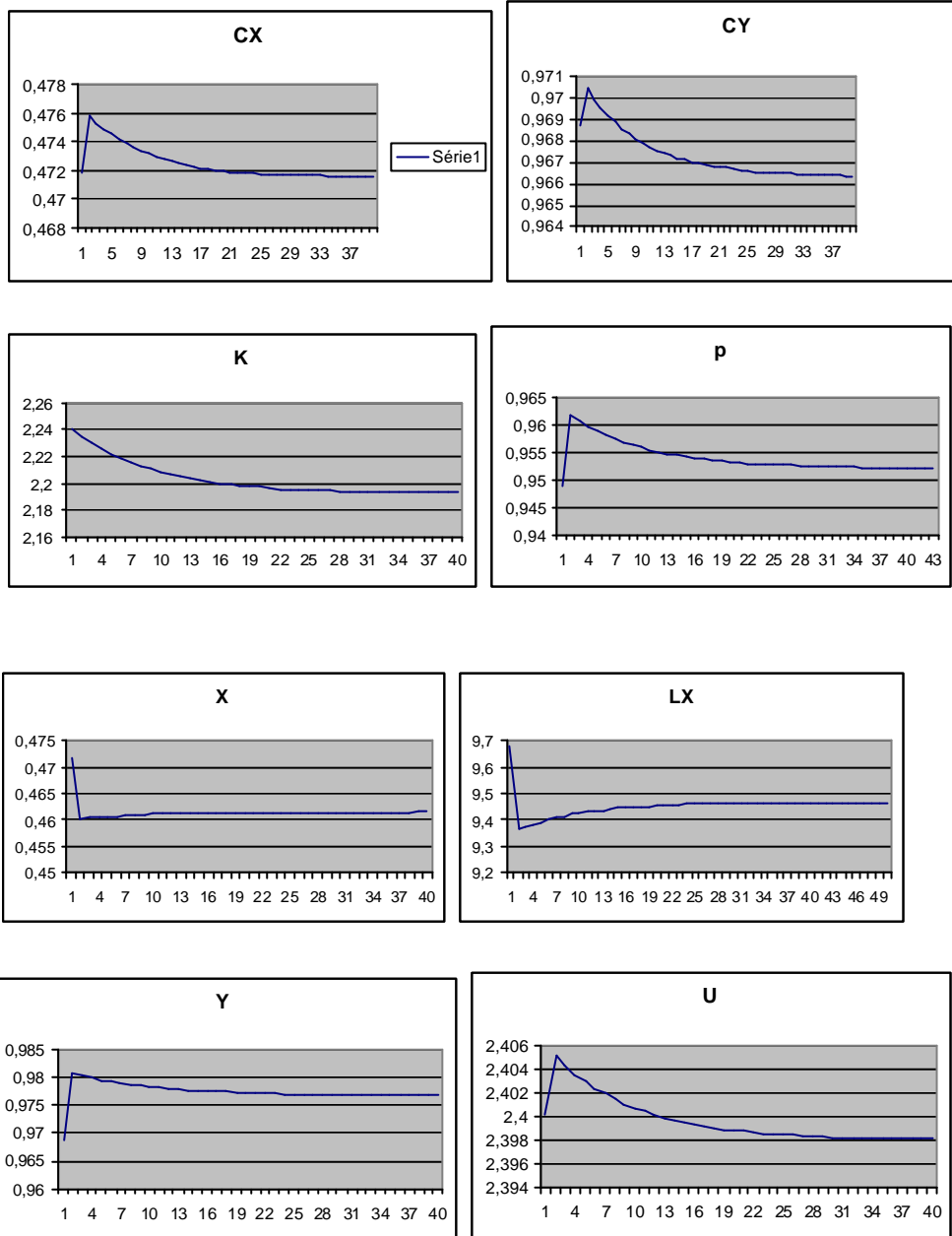
Figure 3. Short- and long-run impacts of tourism

b. *Sensitivity Analysis*

Consider first the case of no capital externality in the production of the tradable good *X* (i.e., **d** = 0). The model is now simulated with some parameters set to values different from their reference values. We obtain the results in Table 1:

Table 1. Sensitivity analysis without externality

	Kc	Xc	Yc	LXc	SW-RW	VP1	VP2
Central account	2.241	0.472	0.969	9.676	0.000579	0.886	1.188
sigma-0.4	2.272	0.478	0.962	9.808	0.000644	0.886	1.189
sigma+2.5	2.051	0.432	1.011	8.872	0.000368	0.887	1.187
gamma+2	2.241	0.472	0.969	9.676	0.000305	0.936	1.125
gamma-0.4	2.241	0.472	0.969	9.676	0.000649	0.857	1.228
rau-0.01	2.831	0.472	0.969	9.676	0.008092	0.907	1.148
rau+0.01	1.848	0.472	0.969	9.676	0.000484	0.865	1.229
rau+0.04	1.193	0.472	0.969	9.676	0.000327	0.808	1.359
alfa+0.1	1.345	0.472	0.969	10.471	0.000454	0.832	1.265
beta+0.1	2.241	0.472	0.969	8.860	0.000441	0.881	1.195
b+0.1	2.906	0.612	0.821	12.459	0.000579	0.890	1.183
b+0.3	4.225	0.889	0.529	17.866	0.000724	0.896	1.175

The first column in Table 1 provides the list of the parameters, which were changed, and the amount of change (for instance, parameter **r** was decreased by 0.01). The next four columns present the initial values (before the openness of the economy to tourism) of capital, both outputs and employment in the tradable sector. The following column is the most important and it gives the difference between overall welfares when the economy opens to tourism and when the economy stays closed to tourism. The last two columns provide the eigenvalues.

As indicated by the positive values of *SW–RW*, tourism always increases welfare. How sensitive is the gain in welfare to the spending of tourists? For the reference values of the parameters, overall welfare increases with tourism: The gain in welfare is: 0.000579, 0.002303, 0.014178, 0.05566, and 0.22015, corresponding to values of *T* at 0.01, 0.02, 0.05, 0.10, and 0.20.

We now turn to the case with the externality in the tradable sector. We ran the same simulation as the reference simulation, but with a value of the parameter **d** progressively increasing. The initial values of capital, outputs and employments stay the same across these simulations. The results are presented in Table 2:

Table 2. Sensitivity analysis with externality

	SW-RW	VP1	VP2
Central account	0.000579	0.886	1.188
delta=0.004	0.000086	0.887	1.189
delta=0.005	-0.000037	0.887	1.189
delta=0.01	-0.000654	0.888	1.191
delta=0.05	-0.005639	0.897	1.200
delta=0.15	-0.018400	0.918	1.227
delta=0.25	-0.031426	0.935	1.257
delta=0.40	-0.051045	0.955	1.307
delta=0.8	-0.101016	0.986	1.464
delta=1.2	UNSTABLE	1.002	1.636

1. The gain in welfare created by the openness of the economy to tourism decreases when the externality of productions in the tradable sector increases. The gain turns into a loss for a low value of this externality (for a value of **d** approximately equal to 0.0047).

2. The model converts to an endogenous growth model for a high value of **d** (about 1.2).

3. It is worthwhile to point out that the discounted instantaneous utility decreases at the rate of the smallest eigenvalue. We know that in the long run this instantaneous utility is smaller when the economy is open to tourism than when it is closed to tourists. By summing the discounted utilities over 250 periods we overestimate the gain from tourism. However, this error is very weak for an eigenvalue of the order of 0.9. It becomes higher for an eigenvalue of the order of 0.95 and still higher for an eigenvalue of the order of 0.98. Thus, the decrease in the gain in utility induced by tourism when the externality increases is faster than what appears in Table 2.

5. Conclusions

Using a dynamic framework, this paper has examined the effects of tourism on capital accumulation, sectoral output and domestic welfare for an open economy with a capital-generating externality in the traded manufacturing sector. Foreign tourists visit the country and consume the local non-traded good only. An expansion of tourism raises the prices of the non-traded good, yielding a gain in revenue. Since tourism turns the non-traded into an exportable good, the rise in the good price can be considered as a terms-of-trade improvement. However, the rise in the non-traded price induces a diversion of resources from the manufacturing sector to the rest of the economy. This lowers the demand for domestic capital and hence capital accumulation. This decline in capital puts pressure on the manufacturing sector, resulting in the "Dutch Disease" and de-industrialization. The presence of the externality further worsens this de-industrialization effect, making tourism more likely to be welfare-reducing. This result is supported by numerical simulations.

Two points deserve a mention. First, the Dutch Disease in the literature arises from supply shocks, such as discoveries in natural resources. The Dutch Disease identified in this paper occurs through a demand shock from a tourism boom. Second, in contrast with the welfare improving results obtained in the one-sector, dynamic model of Hazari and Sgro (1995), an expansion in tourism may be immiserizing in our two-sector, dynamic framework. This paper focuses on the welfare effect of tourism. Examining the relationship between tourism and growth would be an item of interest for our future research.

Footnotes

1. For example, tourism spending in Hong Kong has grown steadily from US$7.28 billion accounting for about 4.44% of its GDP in 1998 to US$9.6 billion accounting for about 6.14% of its GDP in 1999.   Similar trend can be found in other major tourist cities.

2. This literature includes Copeland (1991), and Hazari and Sgro (1995, 2001, 2004).

3. Tourism is one of the four main pillars for supporting the Hong Kong economy. The other three pillars are financial, commercial and logistic services.

4. These are the most common categories of tourist consumption, and both Copeland (1991) and Hazari and Ng (1993) were the first to model tourism along these lines.

5. In 1960s, the discoveries of natural gas in the Netherlands inflicted some adverse effects on her manufacturing sector. This is referred to as the Dutch Disease. See Corden and Neary (1982) for a detailed study.

6. This specific-factor model can be found in, for example, Jones (1977).

7. For analytical convenience, population growth is ignored in this paper. Also see section 5.

8. By using the definition of $R(\,\cdot\,)$, we have: $p(Y - C_Y) = (C_X - X) + \dot{K}$. So, the income from tourism is used to finance the imports of good X and accumulation of capital.

9. From (1), (4) and (5), the results of the comparative statics in the short run are: $\partial C_X/\partial K =$ $-lU_{XY}(R_{pK} + R_{pg}g')/J < 0$, $\partial C_Y/\partial K = lU_{XX}(R_{pK} + R_{pg}g')/J < 0$, $\partial p/\partial K = (R_{pK} + R_{pg}g')(U_{XX}U_{YY} - U_{XY}^2)/J > 0$, $\partial C_X/\partial l = [l + (\partial D_Y/\partial p - R_{pp})(U_{YY} - pU_{XY})]/J < 0$, $\partial C_Y/\partial l = (\partial D_Y/\partial p - R_{pp})(pU_{XX} - U_{XY})]/J < 0$, $\partial p/\partial l = (U_{XY} - pU_{XX})]/J < 0$, $\partial C_X/\partial T = lU_{XY}(\partial D_Y/\partial a)/J < 0$, $\partial C_Y/\partial T = -lU_{XX}(\partial D_Y/\partial a)/J < 0$, $\partial p/\partial T = -(\partial D_Y/\partial a)(U_{XX}U_{YY} - U_{XY}^2)/J > 0$, where $J = (\partial D_Y/\partial p - R_{pp})(U_{XX}U_{YY} - U_{XY}^2) + lU_{XX} < 0$.

10. Following Brock (1996), we use $\partial C/\partial K = \partial C_X/\partial K + p(\partial C_Y/\partial K)$ and $\partial C/\partial l = \partial C_X/\partial l + p(\partial C_Y/\partial l)$.

11. If $l - D_Y(U_{XY} - pU_{XX}) > 0$, then we have: $\partial C/\partial l - D_Y(\partial p/\partial l) < 0$.

12. Note that $\Delta = R_{pK}[(R_{pK} + R_{pg}g')(2pU_{XY} - p^2U_{XX} - U_{YY}) - (R_K + R_g g')(U_{XY} - pU_{XX})] + (R_{KK} + R_{Kg}g')H > 0$, where $H = (\partial D_Y/\partial p)(2pU_{XY} - p^2U_{XX} - U_{YY}) - [l - D_Y(U_{XY} - pU_{XX})] < 0$ by the condition of saddle-point stability that $l - D_Y(U_{XY} - pU_{XX}) > 0$.

13. From (1), (4), (5) and (13), we have: $dp(0)/dT = -(\partial D_Y/\partial T)(2pU_{XY} - p^2U_{XX} - U_{YY})/H > 0$.

14. From (1), (4), (5) and (13) we can obtain the change in l at tome 0 as: $dl(0)/dT = (\partial D_Y/\partial T)[D_Y(U_{XX}U_{YY} - U_{XY}^2) + l(U_{XY} - pU_{XX})/H < 0$.

15. The change in l in steady state depends on the relative shifts of the schedules of $\dot{l} = 0$ and $\dot{K} = 0$; that is, $d\tilde{l}/dT = (\partial D_Y/\partial T)[(U_{XX}U_{YY} - U_{XY}^2)[D_Y(R_{KK} + R_{Kg}g') - R_{pK}(R_K + R_g g')] + l(R_{KK} + R_{Kg}g')(U_{XY} - pU_{XX})]/\Delta > (<) 0$, where $\Delta > 0$.

16. See Brock (1996) for this procedure of welfare analysis.

17. We define: $e_{rK} = -(R_K + R_g g')/K(R_{KK} + R_{Kg}g') = -(dK/dr)(r + R_g g')/K > 0$, where $r = R_K(g, p, K)$ and $dr/dK = R_{Kg}g' + R_{KK}$, and $e_{KY} = -KR_{pK}/R_p = -(\partial Y/\partial K)(K/Y) > 0$.

18. The rate of return on capital is $r = R_K(g, p, K)$. Since $R_K(\cdot)$ is homogeneous of degree one in g and p, we have $r = gR_{gK} + pR_{pK}$. Letting $e_{KX} = KR_{gK}/R_g = (\partial X/\partial K)(K/X)$ be the output elasticity to capital is sector X and $q_{KX} = rK/X$ be the cost share of capital in sector X, we get: $e_{KY} = c(e_{KX} - q_{KX})$, where $\chi = X/PY$. A positive relationship exists between e_{KY} and e_{KX}.

19. L_X is held fixed in our computation because of the envelope theorem. In the maximization with respect to capital, consumers do not take into account the externality term K_{-1}^d.

20. The model was simulated and its eigenvalues computed with the software Dynare, which was run under Matlab. Dynare was developed by Michel Juillard, and can be unloaded from the website: http://www.cepremap.cnrs.fr/dynare.

References

Brock, P. L., 1996, "International Transfers, the Relative Price of Non-traded goods, and the Current Account," *Canadian Journal of Economics*, 29, 161-180.

Copeland, B. R., 1991, "Tourism, Welfare and De-industrialization in a Small Open Economy," *Economica*, 58, 515-529.

Corden, W. M. and J. P. Neary, 1982, "Booming Sector and De-industrialization in a Small Open Economy," *Economic Journal*, 92, 825-848.

Hazari, B.R. and A. Ng, 1993, "An analysis of tourists' consumption of non-traded goods and services on the welfare of the domestic consumers", *International Review of Economics and Finance*, 2, 3-58.

Hazari, B. R. and J. J. Nowak, 2003, "Tourism, Taxes and Immiserization: a Trade Theoretic Analysis," *Pacific Economic Review*, 8, 279-287.

Hazari, B. R., J. J. Nowak, M. Sahli and D. Zdravevski, 2003, "Tourism and Regional Immiserization," *Pacific Economic Review*, 8, 269-278.

Hazari, B. R. and P. M. Sgro, 1995, "Tourism and Growth in a Dynamic Model of Trade," *Journal of International Trade and Economic Development*, 4, 243-252.

Hazari, B. R. and P. M. Sgro, 2001, *Migration, Unemployment and Trade*, Norwell, Massachusetts: Kluwer Academic Publishers.

Hazari, B. R. and P. M. Sgro, 2004, *Tourism and Trade*, Amsterdam: Elsevier (forthcoming).

Jones, R. W., 1977, "A Three Factor Model in Theory, Trade, and History," in *Trade, Balance of Payments and Growth*, J. N. Bhagwati, et al. eds., Amsterdam: North-Holland.

Luzzi, G. F. and Y. Fluckiger, 2003, "Tourism and International Trade: Introduction," *Pacific Economic Review*, 8, 239-243.

Nowak, J. J., M. Sahli, and P. M. Sgro, 2003, "Tourism, Trade and Domestic Welfare," *Pacific Economic Review*, 8, 245-258.

Turnovsky, S. J., 1999, *International Macroeconomic Dynamics*, MIT Press, Cambridge, MA.