Tourism, Jobs, Capital Accumulation and the Economy: A Dynamic Analysis

Chi-Chur Chao [a,b], Bharat R. Hazari [b], Jean-Pierre Laffargue [c],
Pasquale M. Sgro [b], and Eden S. H. Yu [d]

[a] Department of Economics, Chinese University of Hong Kong, Shatin, Hong Kong
[b] Deakin Business School, Deakin University, Malvern, Victoria 3144, Australia
[c] CEPREMAP, 46 boulevard Jourdan, 75014 Paris, France
[d] Department of Economics and Finance, City University of Hong Kong, Kowloon, Hong Kong

Abstract: This paper examines the effects of tourism in a dynamic model of trade on unemployment, capital accumulation and resident welfare. A tourism boom improves the terms of trade, increases labor employment, but lowers capital accumulation. The reduction in the capital stock depends on the degree of factor intensity. When the traded sector is weakly capital intensive, the expansion of tourism improves welfare. However, when the traded sector is strongly capital intensive, the fall in capital can be a dominant factor in lowering national welfare. This dynamic immiserizing result of tourism on resident welfare is confirmed by simulations on German data.

Key words: Tourism, employment, capital accumulation, welfare
JEL classifications: O10, F11

1. Introduction

Tourism is a growing and important industry in both developed and developing countries. It is also an important source of earning foreign exchange and provides employment opportunities for domestic labor. Generally, tourist consumption in the receiving country is predominantly of non-traded goods and services. This type of consumption can be very significant in economies suffering a cyclical downturn in their traded-goods sector in times of recession. The recent recovery of the Hong Kong economy is an excellent example of tourism-led growth with job creation. The restructuring and relocation of manufacturing processes to China in the past two decades has resulted in unemployment of unskilled workers in Hong Kong. The Asian financial crisis in 1997 and the SARS outbreak in 2003 had made the situation even worse, and the unemployment rate in Hong Kong reached more than 7 per cent. Since April 2003, China allowed individuals from selected cities to visit Hong Kong. This resulted in tourism growth. About four million Chinese tourists came to Hong Kong, which in turn created job opportunities and substantially reduced unemployment.[1]

Tourism research has concentrated on understanding the effects of tourism on the economy both in distortion and distortion-free models. In the latter models,[2] a tourism boom via a demand push raises the relative price of the non-traded good. Since tourism is essentially exports of services, this gain in the "tertiary terms of trade" improves residents' welfare. Subsequent research has extended the analysis of the effects of tourism in two directions. The first direction is to examine static economies with distortions. Hazari, et al. (2003) and Nowak et al. (2003) are examples of this line of research, where the former analyzes the welfare effect of tourism in a Harris-Todaro (1970) economy, while the latter introduces increasing returns to scale in the economy. The second direction of research is the analysis of tourism in dynamic models of trade. Using a one-sector growth model, Hazari and Sgro (1995) found that tourism without monopoly power in trade is necessarily welfare improving. Recently, Chao, et al. (2005) demonstrated that an expansion of tourism may result in capital decumulation, thereby lowering welfare in a two-sector model with a specific type of distortion, namely, capital-generating externality. However, the relationship between tourism and employment remains unexplored in the literature. Does an expansion in tourism create more jobs in the local economy, reduce the unemployment rate and hence improve workers' welfare? We explore this problem in a uniform minimum-wage dynamic economy,[3] and extend the framework by incorporating capital adjustments in the long run. The assumption of a minimum wage is captured by wage indexation. We find that because of the nature of labor intensity of the tourism industry, the expansion of tourism raises demand for labor and increases employment. Nonetheless, the expansion of the tourism sector may lead to capital decumulation in other traded sectors. When the traded sector is strongly capital intensive relative to the non-traded good sector, the fall in the capital stock plays a dominant role that can lower economic welfare. Therefore, in evaluating the effectiveness of tourism to the economy, a trade off exists between the gain in employment and the loss in capital decumulation. German data is used to simulate these results.

The structure of this paper is as follows. Section 2 sets out a dynamic model with capital accumulation for examining the effects of tourism on the relative price of the non-traded good, labor employment, capital accumulation and welfare in the short and long runs. Section 3 provides numerical simulations for the effects of tourism on the economy. Section 4 outlines the main findings and conclusions.

2. The Model

We consider an open economy that produces two goods, a traded good X and a non-traded good Y, with production functions: $X = X(L_X, K_X, V_X)$ and $Y = Y(L_Y, K_Y, V_Y)$. The variables L_i, K_i and V_i denote the allocation of labor and capital and specific factor employed in sector i, $i = X, Y$. While both labor and capital are perfectly mobile between sectors, there are specific factors to each sector.[4] So, the model considered is a hybrid of the Heckscher-Ohlin and the specific-factors model. Commodity X has been chosen as the numeraire. The relative price of the non-traded good Y is denoted by p. The production structure of the model is expressed by the revenue function: $R(1, p, K, L) = \max \{X(L_X, K_X, V_X) + pY(L_Y, K_Y, V_Y): L_X + L_Y = L, K_X + K_Y = K\}$, where L is the actual level of labor employment and K is the stock of capital in the economy. The fixed endowments of specific factors V_i have been suppressed in the revenue function. Denoting subscripts as partial derivatives and employing the envelope property, it follows: $R_p = Y$, being the output of good Y, and $R_{pp} > 0$, expressing the positive supply curve. Stability condition of this system requires that sector Y is labor intensive relative to sector X.[5] This gives: $R_{pL} > 0$ and $R_{pK} < 0$, by the Rybczynski theorem. The rental on capital r equals R_K. The specificity of factors V_i results in $R_{KK} < 0$ and $R_{KL} > 0$.[6] Let w denote the wage rate, then the level of total employment is determined by

$$R_L(1, p, K, L) = w, \quad (1)$$

where $R_{LL} < 0$ due to diminishing returns of labor.[7] Note that the wage rate is set by the government according to the goods prices, i.e., $w = w(1, p)$, with $\partial w/\partial p > 0$ and $(p/w)(\partial w/\partial p) \leq 1$. This real wage indexation results in economy-wide unemployment, measured by $\overline{L} - L$, where $\overline{L}$ is the exogenously given labor endowment in the economy.

We now consider the demand side of the economy. Domestic residents consume both goods, C_X and C_Y, while foreign tourists demand only the non-traded good Y. Let $D_Y(p, T)$ be the tourists' demand for good Y, where T is a shift parameter capturing the tastes and other exogenously given variables, for example, foreign income, with $\partial D_Y/\partial T > 0$. The market-clearing condition for the non-traded good requires the equality of demand (where this consists of domestic and tourist demand) and supply:

$$C_Y + D_Y(p, T) = R_p(1, p, K, L). \quad (2)$$

This equation determines the relative price of the non-traded good, p.

In a dynamic setting, domestic savings out of consumption of goods X and Y are used for capital accumulation:

$$\dot{K} = R(1, p, K, L) - C_X - pC_Y, \tag{3}$$

where the dot over the variable denotes its time derivative. Note that in exchange for tourism exports, capital is imported at a given world price which is normalized to unity.

Under the budget constraint (3), the domestic residents maximize the present value of their instantaneous utility, $U(\cdot)$. The overall welfare W is therefore:

$$W = \int_0^\infty U(C_X, C_Y)e^{-rt}dt, \tag{4}$$

where r represents the rate of time preference. Let l denote the shadow price of capital in the economy. The first-order conditions with respect to C_X and C_Y are:

$$U_X(C_X, C_Y) = l, \tag{5}$$

$$U_Y(C_X, C_Y) = l\,p. \tag{6}$$

where U_X and U_Y denote marginal utilities of consuming good X and Y respectively.

In addition, the evolution of the shadow price of capital is governed by the following dynamic equation:

$$\dot{l} = l[r - R_K(1, p, K, L)], \tag{7}$$

which is a function of the difference between the subjective rate of time preference and the return to capital.

Using the above framework, we can examine the resource allocation and welfare effects of tourism on the economy in the short and long runs.

(*a*) *Short-run equilibrium*

In the short-run equilibrium, the initial amount of capital K is given by K_0 as its shadow price is fixed.[8] For a given value of the tourism parameter T, the system can be solved for L, p, C_X and C_Y by using equations (1), (2), (5) and (6) as functions of K, l and T; $L = L(K, l, T)$; $p = p(K, l, T)$, $C_X = C_X(K, l, T)$ and $C_Y = C_Y(K, l, T)$. An increase in capital, K, raises the productivity of labor and hence labor employment ($\partial L/\partial K > 0$). However, the increase in capital lowers the supply of good Y by the Rybcyznski effect, which raises its price ($\partial p/\partial K > 0$). This in turn lowers the demand for good Y by domestic residents ($\partial C_Y/\partial K < 0$). Furthermore, for $U_{XY} > 0$ the decreased consumption of good Y lowers marginal utility of good X, which reduces the demand for good X ($\partial C_X/\partial K < 0$). Similarly, a rise in the shadow price of capital lowers the demand for labor in production ($\partial L/\partial \lambda < 0$) and the demand for goods in consumption ($\partial C_X/\partial \lambda < 0$ and $\partial C_Y/\partial \lambda < 0$). This results in the fall in the relative price of the non-traded good ($\partial p/\partial \lambda < 0$). In addition, a rise in tourism increases the demand for the non-traded good and hence its price ($\partial p/\partial T > 0$). This leads to an increase in employment in the economy, $\partial L/\partial T > 0$. However, the higher price also reduces the demand for both goods by domestic residents ($\partial C_X/\partial T < 0$ and $\partial C_Y/\partial T < 0$).[9]

(*b*) *Dynamics*

We can utilize the short-run comparative-static results to characterize the local dynamics of the model. The dynamics of domestic capital accumulation in equation (3) and its shadow prices in equation (7) are:

$$\dot{K} = R[1, p(K, \lambda, T), K, L(K, \lambda, T)] - C_X(K, \lambda, T) - p(K, \lambda, T)C_Y(K, \lambda, T), \quad (8)$$

$$\dot{\lambda} = \lambda\{r - R_K[1, p(K, \lambda, T), K, L(K, \lambda, T)]\}. \quad (9)$$

Taking a linear approximation of the above system around the equilibrium, we have:

$$\begin{bmatrix} \dot{K} \\ \dot{\lambda} \end{bmatrix} = \begin{bmatrix} A & B \\ M & N \end{bmatrix} \begin{bmatrix} K - \tilde{K} \\ \lambda - \tilde{\lambda} \end{bmatrix} \quad (10)$$

where a tilde (~) over a variable denotes its steady-state level. Note that $A = R_K + R_L(\partial L/\partial K) + D_Y(\partial p/\partial K) - \partial C/\partial K$, $B = R_L(\partial L/\partial \lambda) + D_Y(\partial p/\partial \lambda) - \partial C/\partial \lambda$, $M = -\lambda[R_{KK} + R_{KL}(\partial L/\partial K) + R_{Kp}(\partial p/\partial K)]$ and $N = -\lambda[R_{Kp}(\partial p/\partial \lambda) + R_{KL}(\partial L/\partial \lambda)]$.[10] The signs of A, B, M and N are in general indeterminate.

However, for our purposes, $A > 0$, $M > 0$ and $N < 0$ when $R_{Kp} < 0$ and $R_{Lp} > \partial w/\partial p$, i.e., the non-traded good Y is labor intensive, and $R_{LL}/R_{LK} < R_{pL}/R_{pK} < R_{KL}/R_{KK}$. Furthermore, $B > 0$ when $h = -(\partial D_Y/\partial p)(p/D_Y) \geq 1$, i.e., the price elasticity of the demand for good Y by tourists is elastic.

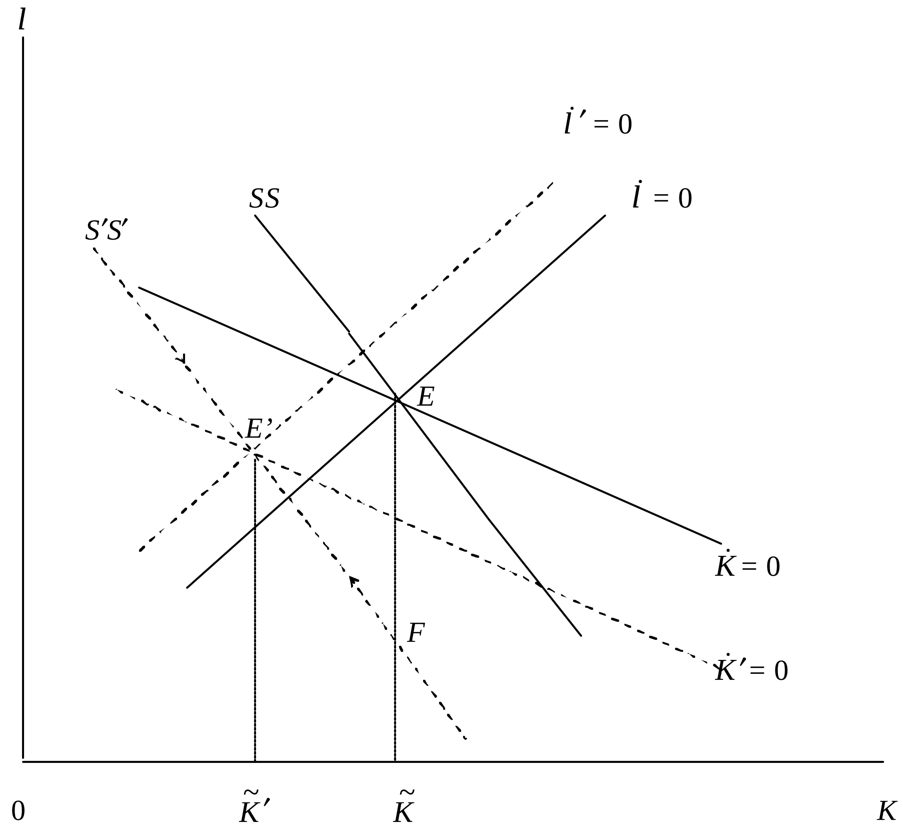

Figure 1. An expansion of tourism

The schedules of $\dot{K} = 0$ and $\dot{l} = 0$ are depicted in Figure 1, with the slopes of $dl/dK|_K = -A/B < 0$ and $dl/dK|_l = -M/N > 0$ Under these conditions, the determinant of the above coefficient matrix is negative and the steady-state equilibrium is at point E which is a saddle point with one negative and one positive eigenvalue. 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:

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

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

where $q = (m - A)/B < 0$, and m is the negative eigenvalue in equation (10). The stable arm of the relation between K and l, as shown by equation (12) and also depicted by the SS schedule in Figure 1, indicates that a decrease in K leads to an increase in its shadow price l, and vice versa.

(*c*) *Steady State*

The long-run equilibrium is obtained by using the short-rum equilibrium conditions in equations (1), (2), (4) and (5), together with no adjustments in the capital stock and its shadow price in equations (3) and (7) as:

$$R(1, \tilde{p}, \tilde{K}, \tilde{L}) - \tilde{C}_X - \tilde{p}\,\tilde{C}_Y = 0, \tag{13}$$

$$R_K(1, \tilde{p}, \tilde{K}, \tilde{L}) = r. \tag{14}$$

Equations (1), (2), (4), (5), (13) and (14) contain six endogenous variables, $\tilde{L}$, $\tilde{p}$, $\tilde{C}_X$, $\tilde{C}_Y$, $\tilde{K}$ and $\tilde{l}$, along with a tourism parameter, T. This system can be used to solve for the impact of tourism in the long run. An increase in tourism on the long-run price of the non-traded good Y is:

$$d\tilde{p}/dT = S(\partial D_Y/\partial T)(p^2 U_{XX} + U_{YY} - 2pU_{XY})/\Delta > 0, \tag{15}$$

where $U_{XX} < 0$, $U_{YY} < 0$, and $\Delta < 0$.[11] Note that $S = R_{KK}R_{LL} - R_{KL}^2 > 0$ by the concavity of the production functions. Hence, an increase in tourism will necessarily improve the tertiary terms of trade.

In addition, from equations (1) and (14), we can obtain the long-run effects of tourism on the capital stock and labor employment, as follows:

$$d\tilde{L}/dT = = [R_{pK}R_{KK}(R_{KL}/R_{KK} - R_{pL}/R_{pK})/S](d\tilde{p}/dT) > 0, \tag{16}$$

$$d\tilde{K}/dT = -[R_{pK}R_{KL}(R_{LL}/R_{LK} - R_{pL}/R_{pK})/S](d\tilde{p}/dT) < 0, \tag{17}$$

where recalling that $R_{LL}/R_{LK} < R_{pL}/R_{pK} < R_{KL}/R_{KK}$ for stability. An increase in tourism will increase employment in the long run, but at the expense of capital accumulation in the economy. The reduction in the capital stock can be seen in Figure 1. A boom in tourism shifts both schedules of $\dot{K} = 0$ and $\dot{l} = 0$ to the left.[12] Since the capital stock is given at time 0, the adjustment path takes the system from point E to point F. This immediately leads to a fall in the shadow price of capital,[13] and consequent reductions in capital accumulation from point F to a new equilibrium at point E'.[14]

(*d*) *Welfare*

We are now in a position to examine the effect of tourism on overall welfare of the economy. Total welfare in equation (4) can be obtained from the sum of the instantaneous utility $Z = U(C_X, C_Y)$. Following Turnovsky (1999, p. 138), 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. However, total welfare is $W = \tilde{Z}/r + [Z(0) - \tilde{Z}]/(r - m)$, and the welfare change is: $dW = [dZ(0) - (m/r)d\tilde{Z}]/(r - m)$, where $-m/r$ (> 0) denotes the discount factor. Utilizing equation (13), the change of total welfare caused by a tourism boom is:

$$dW/dT = [l/(r - m)]\{D_Y[dp(0)/dT - (m/r)(d\tilde{p}/dT)] + R_L[dL(0)/dT - (m/r)(d\tilde{L}/dT)]$$

$$- (m/r)R_K(d\tilde{K}/dT)\}. \tag{18}$$

where $p(0)$ and $L(0)$ denote the relative price of the non-traded good and labor employment at time 0. Since the capital stock is given at time 0, a tourist boom immediately increases the demand for good Y and hence its price. As a consequence, higher labor demand is needed for producing more good Y. These results can be derived from using equations (1), (2), (5), (6) and (13) as

$$dp(0)/dT = -(\partial D_Y/\partial T)R_{LL}(2pU_{XY} - p^2U_{XX} - U_{YY})/H > 0, \quad (19)$$

$$dL(0)/dT = -(R_{pL}/R_{LL})(dp(0)/dT) > 0, \quad (20)$$

where $H > 0$.[15]

The welfare effects of tourism in equation (18) depend on the changes in the terms of trade, labor employment and capital accumulation. An expansion of tourism increases the initial and steady-state relative price of the non-traded good, Y, which yields a gain in the terms of trade as shown in the first term in the curly bracket in equation (18). While the static terms-of-trade effect is well known in the literature, the impact of tourism on labor employment and capital accumulation is generally not mentioned in the literature. These are of critical importance in analyzing economic welfare. As indicated in second term of equation (18), tourism can generate more labor employment in the short and the long run via the higher price of the non-traded good. However, the higher price of the non-traded good can reduce the demand for capital, causing a welfare loss as shown by the third term in equation (18). Due to these conflicting forces, the welfare effect of tourism is in general ambiguous. To illustrate the strength of our results we will use simulations to ascertain the welfare effects of tourism both in the short and the long run.

3. Simulations

To calibrate the effects of an increase in tourism on the endogenous variables of the economy, we need to specific functional forms for the utility and production functions.

(*a*) *Specifications*

We assume that the production of the traded and non-traded goods takes place with the help of Cobb-Douglas production functions:

$$X = A L_X^{a_1} K_X^{a_2} V_X^{1-a_1-a_2}\ , \tag{21}$$

$$Y = B L_Y^{b_1} K_Y^{b_2} V_Y^{1-b_1-b_2}\ , \tag{22}$$

where A and B are the constant technology factors, and a_i and b_i are respectively the ith factor shares in productions of goods X and Y. Total employment for sectors X and Y in the economy is given by

$$L = L_X + L_Y. \tag{23}$$

Similarly, capital allocation between sectors is:

$$K_{-1} = K_X + K_Y. \tag{24}$$

Note that total capital is inherited from the past and is fixed in the short run, but it can be freely allocated between both sectors. This is the reason why total capital is indexed by -1 (it is predetermined in the short-run equilibrium) and capital allocation in each sector is not indexed.

Given the wage rate w, the rental rate r and the relative price of the non-traded good p, the production sector solves the program: $Max\ X + pY - w(L_X + L_Y) - r(K_X + K_Y)$, subject to $X = A L_X^{a_1} K_X^{a_2}$ and $Y = B L_Y^{b_1} K_Y^{b_2}$. Here, the specific factors V_X and V_Y are normalized to unity. The first-order conditions with respect to L_i and K_i yield equilibrium allocation of labor and capital between sectors:

$$w = a_1 A(K_X / L_X)^{a_2} L_X^{a_1+a_2-1} = pb_1 B\left(K_Y / L_Y\right)^{b_2} L_Y^{b_1+b_2-1}\ , \tag{25}$$

$$r = a_2 A(L_X / K_X)^{a_1} K_X^{a_1+a_2-1} = pb_2 B\left(L_Y / K_Y\right)^{b_1} K_Y^{b_1+b_2-1}. \tag{26}$$

The resulting factor-price frontiers can be deduced from equations (25) and (26):

$$(w/a_1)^{1-a_2}(r/a_2)^{a_2} L_X^{1-a_1-a_2} = A, \tag{27}$$

$$(w/b_1)^{1-b_2}(r/b_2)^{b_2} L_Y^{1-b_1-b_2} = pB. \tag{28}$$

In addition, real wage, denoted by w_c, in the economy is assumed to be rigid in the sense that it is indexed to the price of the consumption goods p_c:

$$w_c = w/p_c, \tag{29}$$

where p_c is defined in equation (32).

On the demand side of the economy, we utilize the CES functional form for the instantaneous utility function of domestic households:

$$U = [b^{1/(1+s)} C_X^{s/(1+s)} + \bar{b}^{s/(1+s)} C_Y^{s/(1+s)}]^{(1+1/s)(1-g)}/(1 - g), \tag{30}$$

where $b \in [0, 1]$ and $\bar{b} = 1 - b$ are the parameters, g expresses the index of relative risk aversion and s captures the elasticity of substitution between the two goods with $1 + s \geq 0$. From the first-order conditions of utility maximization, we derive

$$bC_Y/\bar{b}\, C_X = 1/p^{(1+s)}. \tag{31}$$

Let $C = [b^{1/(1+s)} C_X^{s/(1+s)} + \bar{b}^{s/(1+s)} C_Y^{s/(1+s)}]^{(1+1/s)}$ denote aggregate consumption. Then by using equation (31) we obtain that $C = (C_X/b)(b + \bar{b}\, p^{-s})^{(1+s)/s}$. The relative price of the consumption aggregate is then defined by $p_cC = C_X + pC_Y$, which can be solved for p_c as

$$p_c = (b + \bar{b}\, p^{-s})^{-1/s}. \tag{32}$$

Therefore, the current utility of domestic households can be expressed as: $U(C) = C^{(1-g)}/(1 - g) = [(C_X/b)(b + \bar{b}\, p^{-s})^{(1+s)/s}]^{(1-g)}/(1 - g)$.

The model is closed by using the market-clearing condition for the non-traded good Y:

$$C_Y + D_Y = Y, \tag{33}$$

and the demand for the non-traded good by tourists is specified as

$$D_Y = T/p^h\,, \tag{34}$$

where h measures the price elasticity of demand for good Y by tourists. Tourists spending T, measured in terms of the traded good, is exogenous and tourists consume only non- traded good.

Finally, the budget constraint for each period is:

$$K - K_{-1} + C_X + pC_Y = X + pY. \tag{35}$$

Note that the balance of payments is in equilibrium for each period. From equations (33) and (35), we can deduce that: $K - K_{-1} + C_X - X = pD_Y$. That is, the excess demand for capital and the traded good is financed by income receipts from tourism.

Total welfare of domestic residents is the discounted sum of the instantaneous utility and it can be written as: $W = \Sigma_{t=0}^{\infty}(1 - r)^t[C_X(b + \overline{b}\, p^{-s})^{1+1/s}]^{1-g}/(1 - g)$. This function is maximised relatively to capital and the consumption of the traded good under the series of budget constraints: $K - K_{-1} + C_X(b + \overline{b}\, p^{-s})/b = X + pY = w(L_X + L_Y) + rK_{-1} + v_XV_X + v_YV_Y$. Solving this maximisation program with respect to C_X and K, we obtain the first-order conditions: $(1 - r)^tC_X^{-g}(b + \overline{b}\, p^{-s})^{(1+1/s)(1-g)-1} = d/b$ and $d - d_{+1}(1 + r_{+1}) = 0$ where d is the Langrange multiplier. After the elimination of d and d_{+1}, we have

$$(1 + r_{+1})(1 - r) = (C_X/C_{X,+1})^{-g}[(b + \overline{b}\, p^{-s})/(b + \overline{b}p_{+1}^{-s})]^{(1+1/s)(1-g)-1}. \qquad (36)$$

(*b*) *Calibrations*

Equations (21) – (36) consist of sixteen endogenous variables and a shift parameter of tourist spending T for the economy. We utilize the German data to calibrate the short- and long-run impact of an increase in tourism on the economy. It is assumed that tourists' spending is 0 in the reference steady state. We choose $p = 0.9488$, $X + pY = 1.3909$ and $L = 27.27$, which represent the averages values of these variables for Germany for the period 1996-2002. Units are in trillion of 1995 euros and in millions of persons. We set: $T = 0$, $s = -0.5$, $b = 1/3$, $r = 0.05$, $a_1 = 0.30$, $a_2 = 0.50$, $b_1 = 0.5$, $b_2 = 0.10$, $l = 0.5$ and $h = 1$.[16] Note that the labor intensity of good Y is captured by the chosen values of a_i and b_i. The steady-state values of the sixteen endogenous variables can be then computed according to: $D_Y = 0$, $X = (X + pY)/[1 + (\overline{b}/b)p^{-s}]$, $Y = (X + pY - X)/p$, $C_Y = Y$, $C_X = X$, $r = 1/(1 - r) - 1$, $L_Y = [b_1pY/(a_1X + b_1pY)]L$, $L = L_X + L_Y$, $K_Y = b_2pY/r$, $B = Y/L_Y^{b_1}K_Y^{b_2}$, $w = pb_1B^{1/(1-b_2)}(pb_2/r)^{b_2/(1-b_2)}L_Y^{-(1-b_1-b_2)/(1-b_2)}$, $K_X = a_2X/r$, $A = X/(L_X^{a_1}K_X^{a_2})$, $U =$

$\left[b^{1/(1+s)}C_X^{s/(1+s)} + \bar{b}^{1/(1+s)}C_Y^{s/(1+s)}\right]^{(1+1/s)(1-g)}/(1 - g)$, $K = K_X + K_Y$, and $p_c = (b + \bar{b}\,p^{-s})^{-1/s}$. The reference steady state values are therefore: $C_X = 0.4718$, $C_Y = 0.9687$, $D_Y = 0$, $K = 6.2285$, $K_X = 4.4821$, $K_Y = 1.7464$, $L = 27.27$, $L_X = 6.4212$, $L_Y = 20.8488$, $p = 0.9488$, $p_c = 0.9657$, $r = 0.0526$, $U = 2.4003$, $w = 0.02204$, $X = 0.4718$ and $Y = 0.9687$.

There is one anticipated variable $C_{X,+1}$ and one predetermined variable K_{-1} in the system. The eigenvalues in the neighbourhood of the reference steady state are equal to 0.9717 and 1.092. So the local condition of existence and uniqueness are satisfied (one of the eigenvalues must be less than one and the other larger than one to get the existence and uniqueness of a solution). As we will compare sums of discounted utilities when the convergence speed to the steady state is slow, we simulated the model over 250 periods.[17]

As for reference simulations, we let tourist spending T to increase from 0 to 0.01 (which means by 10 billions euros, the German value-added in non-tradable goods being 982 billion euros). We obtain the short- and long-run impacts of tourism on the economy, as plotted in Figure 2:

1. C_X and C_Y immediately increase above their reference values, and then progressively decrease but C_Y ends with a level lower than its reference value.
2. L_X immediately falls and then slightly increases, while L_Y immediately rises and then slightly decreases. This gives that total employment L to rise initially and progressively decreases but stays above its reference level.
3. K_X immediately declines and continuously falls, while K_Y immediately rises and then declines. However, total K progressively decreases to a lower level.
4. X immediately decreases and then progressively decreases to a lower level, while Y immediately rises and then progressively decreases to a level which is higher than its reference value.

5. p immediately increases above its reference value, and then progressively decreases but stays above its reference value.
6. U immediately increases above its reference value, and then progressively decreases to a value that is above its reference value. The sum of discounted utilities increases from 343.6305 to 344.0061. Hence, a rise in tourism improves total welfare in the long run.

Consider next the case that the non-traded sector Y is *strongly* labor-intensive relative to the traded sector X. For this case, we choose $b_2 = 0.001$ and leave the other parameters the same as before. The consequent eigenvalues are 0.9683 and 1.093, and the reference steady-state values are the same as in the previous case but for: $K = 4.4996$ and $K_Y = 0.0175$. Consider reference simulations by increasing tourist spending T from 0 to 0.01. We obtain the short- and long-run impacts of tourism, as plotted in Figure 3. Compared to the results in Figures 2 and 3, the patterns of changes in all the endogenous variables are the same. However, in Figure 3, the rise in total employment L is smaller but the fall in capital K is larger. These differences render a different effect of tourism on utility and welfare: although U immediately increases above its reference value, it progressively decreases and reaches a value *below* its reference value. Therefore, the sum of discounted utilities *decreases* from 343.6305 to 343.5839. Thus, owing to the fall in the capital stock, a rise in tourism can lower total welfare when the traded sector is *strongly* capital-intensive relative to the non-traded tourism sector.

4. Conclusions

Using a dynamic general-equilibrium framework, this paper has examined the short- and long-run effects of tourism on labor employment, capital accumulation and resident welfare for an open economy with unemployment via wage indexation. A tourism boom improves the terms of trade, increases labor employment, but lowers capital accumulation if the non-traded tourism sector is labor intensive relative to the other traded sector. Nonetheless, the reduction in the capital stock depends on the degree of factor intensity. When the traded sector is not strongly capital intensive, the fall in capital would not be so severe and the expansion of tourism improves welfare. However, when the traded sector is strongly capital intensive, the fall in capital can be a dominant factor to lower total welfare. This immiserizing result of tourism on resident welfare is confirmed by the German data.

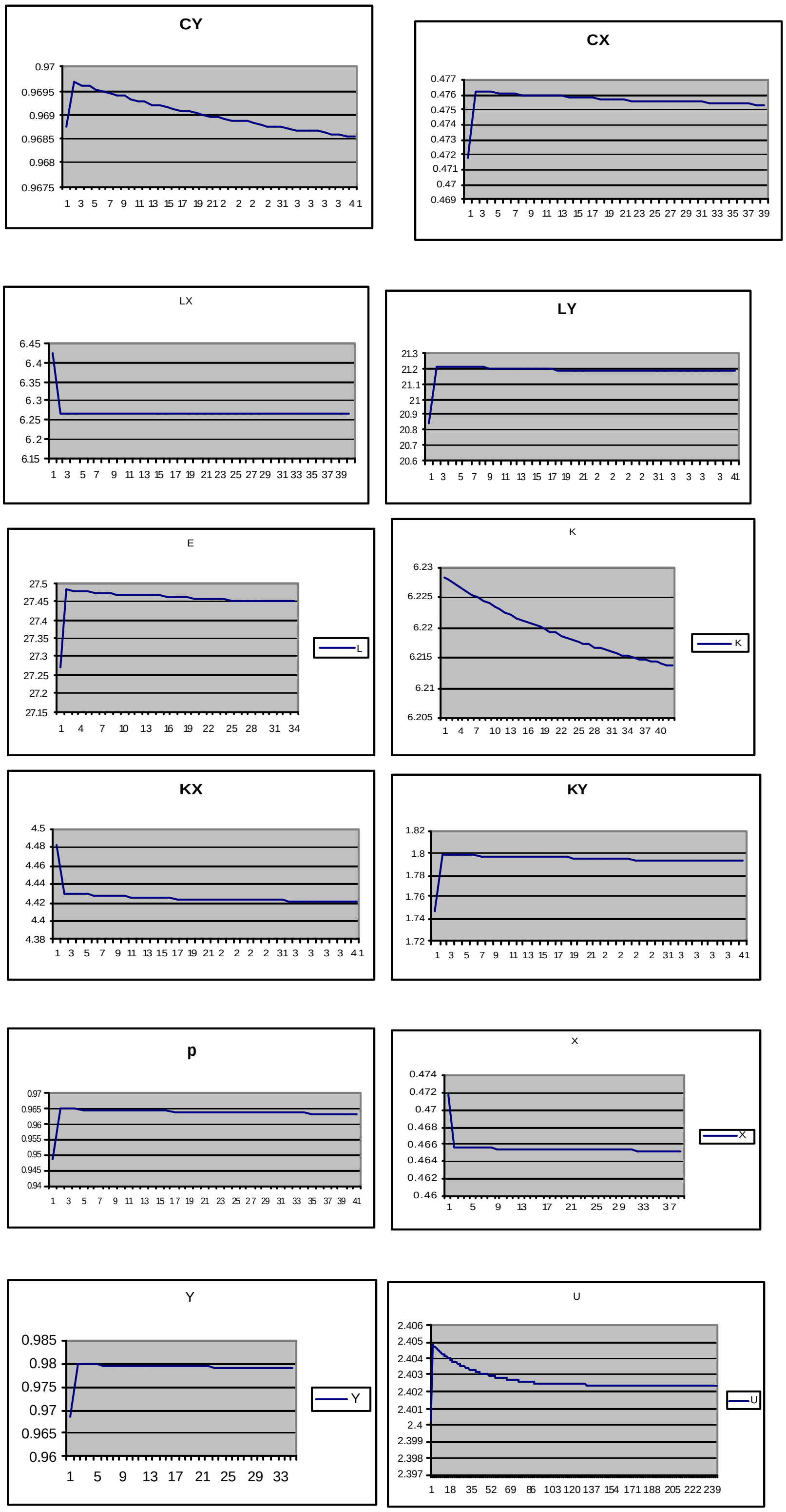

Figure 2. Effects of tourism (b_2 = 0.10)

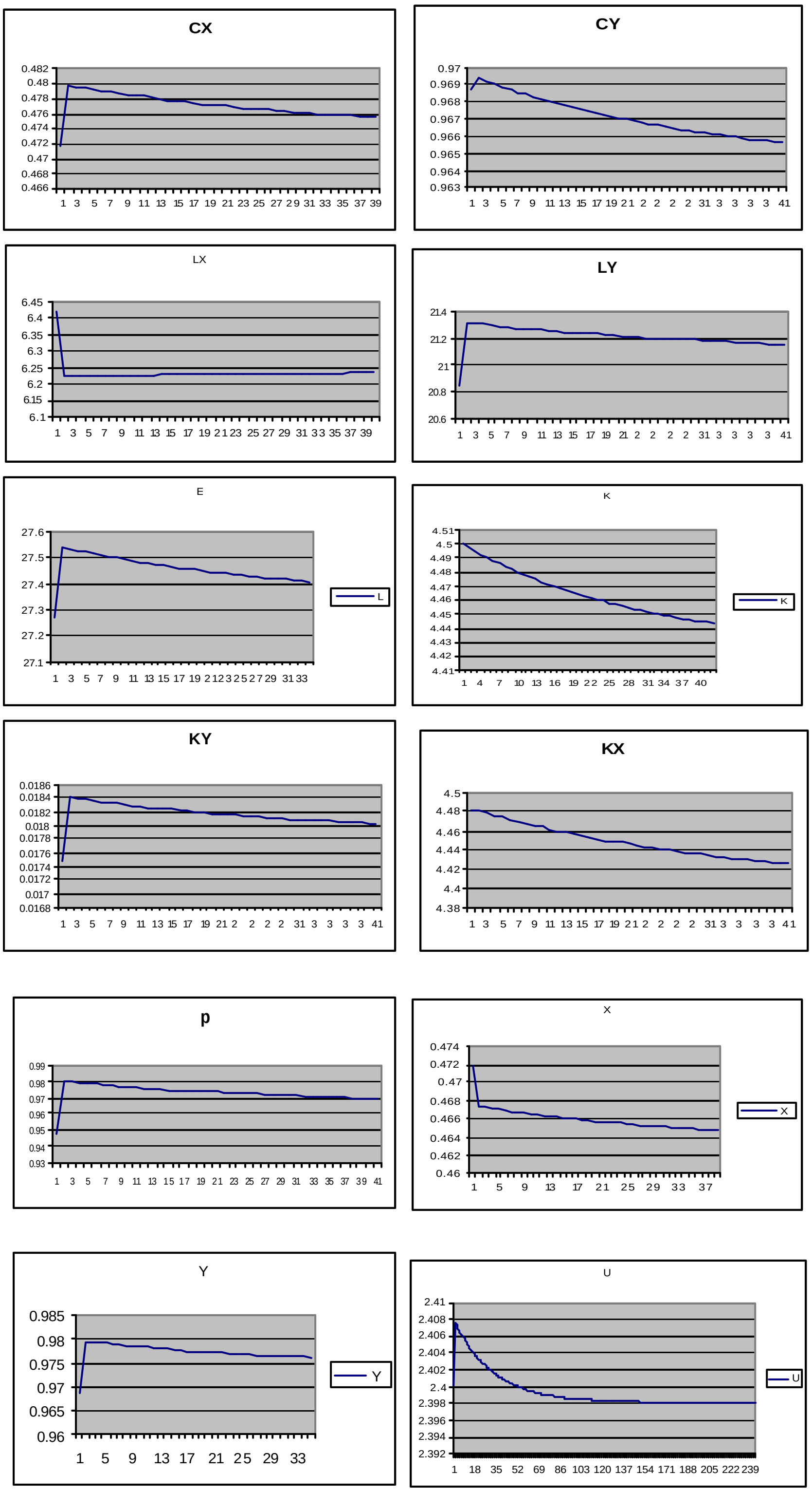

Figure 3. Effects of Tourism (b_2 = 0.001)

Footnotes

1. The economic doldrums were halted and the GDP growth is 8.2 per cent in 2004, well above average 4.8 per cent over the past 20 years. The details can be found in the Budget Speech by the Hong Kong Financial Secretary on March 16, 2005. The simulations in this paper have been done on the basis of German data. Hong Kong data is not easily accessible. Moreover, the results are robust with regard to the choice of the country.
2. See Copeland (1991) and Hazari and Sgro (2004).
3. See Brecher (1974) for the minimum wage model under the Heckscher-Ohlin setting.
4. See Jones (1971) for the specific-factor model and Neary (1978).
5. The stability analysis is provided in the Appendix.
6. Letting $c^i(\cdot)$ be the ith sector unit cost function, by perfect competition we have: $c^X(w, r, v_X) = 1$ and $c^Y(w, r, v_Y) = p$, where w is the fixed minimum wage and v_i are the rates of return on the specific factors V_i. Owing to the existence of the specific factors, the capital return r depends on the good price p and the factor suppliers L and K.
7. A recent study on a generalized minimum wage model can be found in Kreickemeier (2005). Also see Hatzipanayoyou and Michael (1995) and Michael and Hatzipanayoyou (1999) for endogenous labor supply.
8. See Turnovsky (1999, p. 108) for the definition of a short-run equilibrium.
9. Mathematical derivations of the comparative-static results are provided in the Appendix.
10. Following Brock (1996), we use $\partial C/\partial K = \partial C_X/\partial K + p(\partial C_Y/\partial K)$, $\partial C/\partial l = \partial C_X/\partial l + p(\partial C_Y/\partial l)$ and $\partial C/\partial T = \partial C_X/\partial T + p(\partial C_Y/\partial T)$.
11. Note that $\Delta = R_{pK}R_{KK}(R_{KL}/R_{KK} - R_{pL}/R_{pK})\{(U_{XY} - pU_{XX})[R_{1L} - p(\partial w/\partial p)](U_{XY} - pU_{XX}) + (U_{YY} - pU_{XY})(R_{pL} - \partial w/\partial p)\} + R_{pK}R_{LK}(R_{pL}/R_{pK} - R_{LL}/R_{LK})[R_{1K}(U_{XY} - pU_{XX}) + R_{pK}(U_{YY} - pU_{XY})] - (U_{XY} - pU_{XX})(R_KR_{LK} - R_LR_{KK})(\partial w/\partial p) - (R_{LL}R_{KK} - R_{LK}^2)Q < 0$, where $Q = l + D_Y(h - 1)(U_{XY} - pU_{XX})$ -

$(\partial D_Y/\partial p)(pU_{XY} - U_{YY}) + R_{pp}(2pU_{XY} - p^2U_{XX} - U_{YY}) > 0$ by the stability conditions: $h \geq 1$, $R_{pL} > \partial w/\partial p$, $R_{pK} < 0$ and $R_{LL}/R_{LK} < R_{pL}/R_{pK} < R_{KL}/R_{KK}$.

12. For holding l fixed, the shifts of $\dot{K} = 0$ and $\dot{l} = 0$ in Figure 1 are: $dK/dT|_K = -[R_L(\partial L/\partial T) + D_Y(\partial p/\partial T) - (\partial C/\partial T)]/A < 0$ and $dK/dT|_l = l[R_{LK}(\partial L/\partial T) + R_{pK}(\partial p/\partial T)]/M < 0$, where $R_{LK}(\partial L/\partial T) + R_{pK}(\partial p/\partial T) = (\partial D_Y/\partial T)R_{pK}R_{LK}[R_{pL}/R_{pK} - R_{LL}/R_{LK} - (\partial w/\partial p)/R_{pK}](U_{XX}U_{YY} - U_{XY}^2)/J < 0$.
13. From (1), (2), (5), (6) and (13), we can obtain: $dl(0)/dT = (\partial D_Y/\partial T)\{[D_YR_{LL} - R_L(R_{pL} - \partial w/\partial p)](U_{XX}U_{YY} - U_{XY}^2) + lR_{LL}(U_{XY} - pU_{XX})]/H < 0$, where $H = -R_{LL}Q - R_{pL}[R_{1L}(U_{XY} - pU_{XX}) + R_{pL}(U_{YY} - pU_{XY})] + R_L(U_{XY} - U_{XX})(\partial w/\partial p) > 0$.
14. The change in the steady-state value of l depends on the relative shifts of the schedules of $\dot{l} = 0$ and $\dot{K} = 0$; specifically, $d\tilde{l}/da = (\partial D_Y/\partial T)\{(R_{LL}R_{KK} - R_{LK}^2)[D_Y + l(U_{XY} - pU_{XX})] + (U_{XX}U_{YY} - U_{XY}^2)R_{pK}[R_KR_{LK}(R_{pL}/R_{pK} - R_{LL}/R_{LK} - (\partial w/\partial p)/R_{pK}) + R_LR_{KK}(R_{LK}/R_{KK} - R_{pL}/R_{pK} + (\partial w/\partial p)/R_{pK})]\}/\Delta$ Å 0.
15. See footnote 13 for the positive sign of H.
16. Putting the price elasticity different from 1 would not change the results qualitatively.
17. 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

Brecher, R. A., 1974, "Minimum Wage Rates and the Pure Theory of International Trade," *Quarterly Journal of Economics*, 88, 98-116.

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

Chao, C. C., B. R. Hazari, J. P. Laffargue, P. M. Sgro and E. S. H. Yu, 2005, "Tourism, Dutch Disease and Welfare in an Open Dynamic Economy," forthcoming in *Japanese Economic Review*.

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

Harris, J. R. and M. Todaro, 1970, "Migration, Unemployment and Development: a Two-sector Analysis," *American Economic Review*, 60, 126-142.

Hatzipanayoyou, P. and M. S. Michael, 1995, "Tariffs, Quotas and Voluntary Export Restraints with Endogenous Labor Supply," *Journal of Economics*, 62, 185-201.

Hazari, B. R., J. J. Noewak, 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, 2004, *Tourism, Trade and National Welfare,* Amsterdam: Elsevier.

Jones, R. W., 1971, "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.

Kreickemeier, U., 2005, "Unemployment and the Welfare Effects of Trade Policy," *Canadian Journal of Economics*, 38, 194-210.

Michael, M. S. and P. Hatzipanayoyou, 1999, "General Equilibrium Effects of Import Constraints under variable labor supply, public goods and income taxation," *Economica*, 66, 389-401.

Neary, J. P., 1978, "Short-run Capital Specificity and the Pure Theory of International Trade," *Economic Journal*, 88, 488-510.

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*, The MIT Press, Cambridge, Massachusetts.

Appendix: *Short-run Comparative Statics*

From (1), (2), (5) and (6), the results of the comparative statics in the short run are:

$$\partial L/\partial K = -\{[R_{pK}(R_{pL} - \partial w/\partial p) + R_{LK}(\partial D_Y/\partial p - R_{pp})](U_{XX}U_{YY} - U_{XY}^2) + l R_{LK}U_{XX}\}/J > 0,$$

$$\partial C_X/\partial K = l U_{XY}R_{LK}R_{pK}(R_{pL}/R_{pK} - R_{LL}/R_{LK})/J < 0,$$

$$\partial C_Y/\partial K = -l U_{XX}R_{LK}R_{pK}(R_{pL}/R_{pK} - R_{LL}/R_{LK})/J < 0,$$

$$\partial p/\partial K = -R_{LK}R_{pK}(R_{pL}/R_{pK} - R_{LL}/R_{LK})(U_{XX}U_{YY} - U_{XY}^2)/J > 0,$$

$$\partial L/\partial l = -(R_{pL} - \partial w/\partial p)(U_{XY} - pU_{XX})/J < 0,$$

$$\partial C_X/\partial l = \{R_{pL}(R_{pL} - \partial w/\partial p)(U_{YY} - pU_{XY}) + R_{LL}[l + (\partial D_Y/\partial p - R_{22})(U_{YY} - pU_{XY})]\}/J < 0,$$

$$\partial C_Y/\partial l = \{R_{pL}(R_{pL} - \partial w/\partial p)(pU_{XX} - U_{XY}) + R_{LL}(\partial D_Y/\partial p - R_{pp})(pU_{XX} - U_{XY})\}/J < 0,$$

$$\partial p/\partial l = R_{LL}(U_{XY} - pU_{XX})/J < 0,$$

$$\partial L/\partial T = (R_{pL} - \partial w/\partial p)(\partial D_Y/\partial T)(U_{XX}U_{YY} - U_{XY}^2)/J > 0,$$

$$\partial C_X/\partial T = lR_{LL}U_{XY}(\partial D_Y/\partial T)/J < 0,$$

$$\partial C_Y/\partial T = -lR_{LL}U_{XX}(\partial D_Y/\partial T)/J < 0,$$

$$\partial p/\partial T = -R_{LL}(\partial D_Y/\partial \mathrm{T})(U_{XX}U_{YY} - U_{XY}^2)/J > 0,$$

where $J = [R_{pL}(R_{pL} - \partial w/\partial p) + R_{LL}(\partial D_Y/\partial p - R_{pp})](U_{XX}U_{YY} - U_{XY}^2) + lR_{LL}U_{XX} > 0$. We obtain the above signs when the stability condition, $R_{LL}/R_{LK} < R_{pL}/R_{pK} < R_{KL}/R_{KK}$, is imposed.

Using the above results, we can obtain:

$$B = R_L(\partial L/\partial l) + D_Y(\partial p/\partial l) - \partial C/\partial l = \{(U_{XY} - pU_{XX})[R_{LL}D_Y(1 - h) - (R_{Lp} - \partial w/\partial p)(R_L - pR_{Lp})] - [R_{pL}(R_{pL} - \partial w/\partial p) + R_{LL}(\partial D_Y/\partial T)](U_{YY} - pU_{XY}) + R_{pp}R_{LL}(U_{YY} - 2pU_{XY} + p^2U_{XX})\}/J > 0,$$

$$M = -l[R_{KK} + R_{KL}(\partial L/\partial K) + R_{Kp}(\partial p/\partial K)] = -lR_{Kp}(\partial p/\partial K) - l\{R_{pK}R_{KK}(R_{pL} - \partial w/\partial p)(R_{pL}/R_{pK} - R_{LK}/R_{KK})(U_{XX}U_{YY} - U_{XY}^2) + (R_{LL}R_{KK} - R_{LK}^2)[(\partial D_Y/\partial p - R_{pp})(U_{XX}U_{YY} - U_{XY}^2) + lU_{XX}]\}/J > 0,$$

$$N = -\, l[R_{Kp}(\partial p/\partial l) + R_{KL}(\partial L/\partial l)] = -\, lR_{pK}R_{LK}[R_{LL}/R_{LK} - R_{pL}/R_{pK} + (\partial w/\partial p)/R_{pK}](U_{XY} - pU_{XX})/J < 0,$$

where the condition that $h \geq 1$ is imposed in the sign of B. Furthermore, $R_L - pR_{Lp} = R_{L1} < 0$ because R_L is homogeneous of degree one in prices, and the subscript 1 denotes the price of the traded good X, which is relatively capital intensive (i.e., $R_{L1} < 0$ and $R_{Lp} > 0$). In addition, for stability, we need $R_{pL} > \partial w/\partial p > 0$.