Environmental Protection and Tourism with Urban Unemployment*

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Abstract

This study investigates the combined effects of tourism promotion and environmental protection, via a pollution tax, in labor-surplus developing economies. While tourism is expected to provide employment and improve national welfare, the tax is expected to have the opposite effect. This paper is the first of its kind to examine the interaction between tourism and environmental protection by considering production as well as consumption externalities. The results show that, under certain conditions, tourism promotion expands the tourism sector, increases unemployment, and improves welfare. Conversely, under certain conditions, an increase in the pollution tax contracts the sector, decreases unemployment, and reduces welfare.

JEL Classifications: F16, O13, O18

Key words: tourism, environment, pollution tax, unemployment, welfare, externality

1. Introduction

Tourism is an important strategy for economic development in many developing countries. Tourism and related service industries contribute a considerable extent to the GDP in these economies; in 2013, their contribution stood at 9.2%, 12.6%, and 23.4% for Peru, Egypt, and Cambodia, respectively (World Travel & Tourism Council, 2014). Thus, many countries intend to promote tourism by developing hotels and tourist attractions, deploying widespread public relations activities to publicize them, and so on. On the other hand, while tourism contributes to economic development, the construction of tourism infrastructure and the increase in the number of tourists exert harmful effects on the environment.

Various effects of tourism on national economy have been extensively discussed by many trade and development researchers, for example, Copeland (1991); Hazari and Ng (1993); Hazari and Kaur (1995); Hazari et al. (2003); Hazari and Nowak (2003); Nowak et al. (2003); and Hazari and Sgro (2004). One of the negative influences of the influx of tourists is the deterioration of the country’s natural environment, namely, its peace and quiet, pristine natural resources, and so on. The resulting negative marginal utility of pollution exerts serious effects on national welfare. Beladi et al. (2007) examined the effects of tourism on welfare...
and environment. Conversely, tourism also plays an important role in increasing employment and improving national welfare in labor-surplus developing economies. These countries suffer from chronic and widespread unemployment. Some studies have focused on the connection between the environment and unemployment. Examples include Wang (1990); Beladi and Frasca (1999); Daitoh (2003, 2008); Tetsu (2006); Tawada and Sun (2010); and Daito and Omote (2011).

Thus, Yabuuchi (2013) examined the three-sided problem of combining tourism promotion with environmental protection and unemployment concerns at the same time. He investigated the interaction between tourism and the environment by using a general equilibrium model with unemployment and a tourism sector that generates pollution. Considering the impacts of pollution, Yabuuchi (2013), as well as Beladi et al. (2007), concentrated on the negative externality of pollution brought about by the environmental consequences of uncontrolled consumption. However, it goes without saying that one of the externalities of pollution is the damage caused to certain vital industries/sectors engaged in various types of production. A significant example is the serious damage caused to agricultural production by contaminated air and/or water. Thus, it is important to investigate the issue in a model including both production and consumption externalities of pollution.

Thus, in this paper, we will examine the effects of tourism promotion on unemployment and welfare in a model including both these aspects, in the manner of Harris and Todaro (1970). A natural policy prescription for combating environmental degradation and depletion is a pollution tax on the producer of the tourism good. While the tax may reduce the harmful effects on the environment, it may have a negative effect on employment and welfare as it might deter production. Thus, it is interesting and important to investigate the total effects of such a pollution tax on unemployment and welfare. The main findings of this paper are that, under certain conditions, (i) tourism promotion expands the tourism sector, increases unemployment, and improves welfare, and (ii) an increase in the pollution tax contracts the tourism sector, decreases unemployment, and improves welfare. This paper will derive the precise conditions for these results, interpret why they appear paradoxical, and present policy implications.

In section 2, the paper provides a presentation of the basic model and lists the assumptions made therein. Section 3 examines the effects of tourism promotion on output, unemployment, and welfare. In section 4, we investigate the effects of the pollution tax on the economy. Finally, the major findings are outlined with brief concluding remarks in section 5.

### 2. The Model and Assumptions

Following Yabuuchi (2013), consider a small open economy with three sectors, including the tourism sector, and unemployment. One sector is a low-skill (say, an agricultural) sector and produces good $A$. The second sector is a high-skill (say, manufacturing) sector that produces an industrial good $M$. The third sector, $T$, is the tourism sector, where tourism goods, for example, hotels and resort sites, are produced. It is supposed that sector $A$ and $M$ use labor and domestic capital, while sector $T$ uses labor and foreign capital. The economy has a dual structure; that is, it has rural and urban areas. Sector $M$ is located in the urban area, and sectors $A$ and $T$ are located in the rural area. According to Harris and Todaro (1970), we suppose
that the urban wage rate is set relatively higher than the rural wage rate, because of strategic or institutional reasons, for example, a manufacturing promotion policy, a well-organized trade union, a minimum wage law and so on.

The tourism sector has two aspects in the economy. The sector is expected to create employment opportunities in the labor-surplus developing economy and contribute towards improving welfare. On the other hand, the sector’s activities produce harmful effects on the economy through the consumption and production externalities. That is, its activities deteriorate the environment through deforestation and pollution, which has a direct negative effect on national welfare. It also affects other industries negatively, especially the agricultural industry, through water contamination, air pollution, and so on. Thus, the government imposes a pollution tax \( s \) on the production of the tourism good.

The equations for price equal to marginal (and average) cost for the goods are given as

\[
\begin{align*}
  a_{Lm}w_m + a_{Km}r &= p_m, \quad (1) \\
  a_{Lt}w + a_{Kt}r^* &= p_t - s, \quad (2) \\
  a_{Ld}w + a_{Kd}r &= 1, \quad (3)
\end{align*}
\]

where \( a_{ij} \) is the input coefficient of factor \( i \) required to produce one unit of good \( j \) \((i=L, K; j=a, m, t)\), \( r \) and \( r^* \) are the rentals of domestic and foreign capital, respectively. It is assumed that the agricultural good is exported and is **numeraire**, so that its price is unity, while the manufacturing good is imported with fixed world price, \( p_m \). The tourism good is non-traded, and the price, \( p_t \), is determined endogenously in the domestic tourism good market. Also, it is assumed that the tax revenue is transferred to the domestic residents in a lumpsum fashion.

As stated above, the urban wage rate \( (w_m) \) is fixed and set relatively higher than the rural wage rate \( (w) \). Thus, rural workers want to relocate to the urban area in the hope of obtaining a higher income there, although there is a possibility of unemployment. Let \( L_m \) and \( L_u \) be the employed and unemployed labor in the urban area, respectively. Then, the probability of finding a job in the urban manufacturing sector is \((L_m/(L_m+L_u))\). Rural workers will move to the urban area until the expected wage income in the urban sector \((w_mL_m/(L_m+L_u))\) is equal to the actual rural wage rate \( (w) \). Thus, the labor allocation mechanism between the areas can be shown as follows:

\[
w_mL_m/(L_m+L_u) = w.
\]

This can be written as

\[
w(1 + \lambda) = w_m, \quad (4)
\]

where \( \lambda (= L_u/L_m) \) is the unemployed to employed ratio in the manufacturing sector. This ratio plays very important roles in the analysis.

The employment condition in factor markets can be written as

\[
\begin{align*}
  a_{La}X_a + a_{Lm}X_m + (1 + \lambda)a_{Lm}X_m &= L, \quad (5) \\
  a_{Km}X_m &= K, \quad (6) \\
  a_{Kt}X_t &= K^*, \quad (7)
\end{align*}
\]

where \( X_j \) is the output of good \( j \) \((j=a, m, t)\), \( L \) and \( K \) are the endowments of domestic labor.
and capital, respectively, and $K^*$ is the inflow of foreign capital.

We focus our attention on the environmental depletion and degradation caused by tourism promotion activities. Deforestation, land reclamation, and pollution are caused by the construction of hotels and other tourism infrastructure. The effluent/sewage and solid waste generated by hotels, restaurants, and popular tourist venues pollutes the environment. In other words, the tourism sector depletes or degrades the environment. The amount of the pollution generated by it is denoted by $Z$. For the sake of simplicity, it is assumed that one unit of production of the tourism good generates one unit of pollution. Thus, the amount of pollution is equal to the output of the tourism sector, that is,

$$Z = X_t.$$  \hfill (8)

It is also supposed that sector $T$ includes foreign-owned luxury hotels and resorts. It is reasonable to expect that the tourism goods and services are exclusively consumed by foreign tourists, because the domestic residents cannot afford to consume them.\(^1\) Thus, the equilibrium condition of the tourism market is shown as

$$D_t(p_t, Z, T^*) = X_t,$$  \hfill (9)

where $D_t$ is the demand function of tourism and $T^*$ is a shift parameter that shows the level of tourism promotion. It can be seen that $T^*$ increases if, for example, foreigners’ spending increases or the currency of the host country is depreciated. This is particularly true for certain places that are designated as UNESCO world heritage sites. On the other hand, pollution also affects tourism and the consumption of the tourism good. For example, Naples is struggling to deal with large amounts of solid waste, while steadily rising carbon dioxide emissions have been threatening the Great Barrier Reef in Australia. Siano and Siglioccolo (2011) reported how the tourism sector was severely affected by the waste emergency in Naples. Moreover, according to a University of Michigan website on Human Impact on the Great Barrier Reef, “The destruction of corals in the Great Barrier Reef will have an affect the tourism industry. Since corals are the main attractions to these national parks, their destruction will cause a significant decrease in the ecotourism in these areas.” In fact, the number of tourists to Queensland declines continuously since 2007, especially to the Gold Coast and Cairns, while visitors to the other parts of Australia increase during the period (Tourism Queensland, 2012). Thus, it is natural to consider that an increase in $Z$ decreases the demand for tourism, and the increase in $T^*$ increases it.

It is supposed that pollution has a negative effect on agricultural production due to water contamination, air pollution, and so on. This is true even if tourism sites are located far away from agricultural lands, owing to the natural action of rivers and/or westerly winds. For example, pollution from tourism in the mountain areas affects agricultural production in the villages at the foot of the mountain. These effects may be observed even in the neighbouring countries due to the pollution in the river. This can be captured by the following production function:

$$X_a = g_a(X_t) F'_{L_a}(L_a, K_a),$$  \hfill (10)

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1) Beladi, Chao and Hazari (2007) and Yabuuchi (2013) assumed a model in which both domestic residents and foreign tourists consume the tourist good without the production externality of pollution. However, Tetsu (2006) assumed that only foreign tourists consume the tourist good.
where \( g_a(X_t) \) describes the role of the output-generated externality and is a negative function of the output of the tourism sector defined on \((0, \infty)\). It is assumed that \( F^a(L_a, K_a) \) is homogeneous of degree one in the inputs.

There is another interesting intersection of agriculture and tourism. Tourism may promote agricultural production, in cases such as agri-tourism or rural tourism, observed in, say, Italy or other European countries. We can analyze this phenomenon by simply setting \( g_a'(X_t) > 0 \). However, in this paper, we focus our attention on the negative externality alone.

3. Tourism Promotion and Environmental Protection

As mentioned above, the influence of tourism is twofold. First, the tourism sector is expected to create employment opportunities in the labor-surplus developing economy and contribute to improved welfare. Second, the sector’s activities exert harmful effects on the economy through the consumption and production externalities of pollution caused by the production of the tourism good. Thus, it is interesting to examine the effects of tourism promotion and pollution tax on the outputs, (un)employment, and welfare. We will examine the effects of tourism promotion in this section and those of pollution tax in the subsequent section.

Differentiating (2) and considering that the foreign rental \((r^*)\) is fixed, we have

\[
\theta_{L_t} \dot{w} - \theta_{K_t} \dot{r^*} - \pi \dot{p}_t = -\delta \tilde{s},
\]

where \( \theta_{L_t} = wa_{L_t}/(p_t - s) \), etc., \( \pi = p_t/(p_t - s) \), and \( A = dA/A \) for any variable \( A \), \( \delta = s/(p_t - s) \), is the pollution tax rate. It can be seen from (1) that the domestic rental \((r)\) is determined and fixed, since the price of the manufacturing good and the urban wage rate \((w_m)\) are fixed. Thus, differentiating (3) and (10), we obtain

\[
\theta_{L_t} \dot{w} - \xi \dot{X}_t = 0,
\]

since \( \theta_{L_t} \dot{a}_{L_t} + \theta_{K_t} \dot{a}_{K_t} = -\xi \dot{X}_t \), from (10), where \( \theta_{L_t} = wa_{L_t}, \theta_{K_t} = ra_{K_t} \), and \( \xi = X_t g_a'/g_a \) is the elasticity of negative externality of the tourism sector on the agricultural sector.

Then, differentiating (7), we have

\[
\dot{X}_t + \theta_{L_t} \sigma_t (\dot{w} - \dot{r^*}) = \dot{K}^*,
\]

where \( \sigma_t = (\dot{a}_{K_t} - \dot{a}_{L_t})/(\dot{w} - \dot{r^*}) \) is the elasticities of factor substitution in sector \( T \).

Furthermore, differentiating (8) and (9) yields

\[
\alpha \dot{p}_t - (1 + \gamma) \dot{X}_t = -\eta \dot{T}^*,
\]

where \( \alpha = (p_t/D_t) (\partial D_t/\partial p_t) < 0, \gamma = -(Z/D_t) (\partial D_t/\partial Z) > 0 \) and \( \eta = (T^*/D_t) (\partial D_t/\partial T^*) > 0 \).

Equations (11)–(14) can be expressed in the matrix form as

\[
\begin{bmatrix}
\theta_{L_t} & \theta_{K_t} & -\pi & 0 & \dot{w} \\
\theta_{L_t} & \theta_{K_t} & 0 & -\xi & \dot{r^*} \\
0 & 0 & \alpha & -(1 + \lambda) & \dot{p}_t \\
\lambda_{K_t} \theta_{L_t} \sigma_t & -\lambda_{K_t} \theta_{L_t} \sigma_t & 0 & \lambda_{K_t} & \dot{X}_t \\
\end{bmatrix}
\begin{bmatrix}
\dot{K}^* \\
\end{bmatrix}
\]

Thus, by setting \( \dot{s} = 0 \) and \( \dot{K}^* = 0 \), (15) can be solved with respect to \( \dot{T}^* \) as
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\[
\dot{X}_t/\hat{T}^* = \eta \pi \theta_{La} \theta_{La} \sigma_t / \Delta > 0, 
\]
\[
\dot{\nu}/\hat{T}^* = \eta \pi \xi \theta_{La} \sigma_t / \Delta < 0, 
\]
\[
\dot{p}_t/\hat{T}^* = \eta \pi (\theta_{La} + \xi \theta_{La}) / \Delta, 
\]
\[
\dot{r}_t/\hat{T}^* = \eta \pi (\theta_{La} + \xi \theta_{La}) / \Delta, 
\]
where \( \sigma_t = (\hat{a}_{Ka} - \hat{a}_{La}) / (\hat{\nu} - \hat{r}) \) are the elasticities of factor substitution in sector \( A \), and \( \sigma_t = (\hat{a}_{Ka} - \hat{a}_{La}) / (\hat{w} - \hat{r}) \), in sector \( T \), and \( \Delta = (1 + \gamma) \theta_{La} - \alpha \xi \theta_{La} \sigma_t - \alpha \hat{v} \theta_{La} \hat{K}_a \) is the determinant of the coefficient matrix of the equation (15). It can be seen that \( \Delta > 0 \) if we assume the stability of the equation system (see Appendix).

Note that \( \hat{w} = -u \hat{\lambda} \) from (4), where \( u = \hat{\lambda} / (1 + \hat{\lambda}) = L_u / (L_m + L_u) \). Thus, we have the effect of tourism promotion on the unemployed to employed ratio in the manufacturing sector as
\[
\hat{\lambda} / \hat{T}^* = -\eta \hat{\xi} \theta_{La} \sigma_t / u \Delta > 0. 
\]

The effects on the outputs of the traditional sectors are obtained from (5) and (6) by using the aforementioned results. Differentiating (5) and (6), and using (16), (17), (19) and (20), we have
\[
\dot{X}_t/\hat{T}^* = \eta \pi \sigma_t \{ -\lambda_{La} \theta_{La} + \lambda_{La} \theta_{La} (1 + \lambda) \lambda_{La} + \lambda_{La} \sigma_t + \xi \theta_{La} (1 - \sigma_t) \} / \Lambda \Delta, 
\]
\[
\dot{X}_m/\hat{T}^* = \eta \pi \lambda_{La} \sigma_t \{ \lambda_{La} \theta_{La} - \xi \theta_{La} \lambda_{La} \sigma_t + (1 + \lambda) \lambda_{La} \sigma_t \} / \Lambda \Delta, 
\]
where \( \Lambda = \lambda_{La} \lambda_{La} - (1 + \lambda) \lambda_{La} \lambda_{La} \). It is assumed that the manufacturing sector is capital-intensive relative to the agricultural sector in value, that is, \( \Lambda = \lambda_{La} \lambda_{La} - (1 + \lambda) \lambda_{La} \lambda_{La} > 0 \).

Thus, the results are summarized in the following proposition.

**Proposition 1:** Tourism promotion increases the output of the tourism good. It expands the manufacturing sector, while it contracts the agricultural sector if \( \sigma_t < 1 \).

The results are rather natural. It may be expected that tourism promotion naturally expands sectors \( T \), as the policy intends. Tourism promotion actually increases the output even when the negative externality of pollution on the production of the agricultural good exists. The increase in \( T^* \) increases the demand for the tourism good \( (D_t) \), followed by an increase in demand for production \( (X_t) \). On the other hand, the increase in \( X_t \) reduces \( D_n \), due to the negative consumption externality. Thus, it cancels out a part of the initial increase in \( D_t \). Anyway, our result shows that the output of the tourism good eventually increases. This, in turn, absorbs labor from the traditional sectors; hence, it decreases the production of the labor-intensive agricultural sector, \( A \), and increases the production of the capital-intensive sector, \( M \), according to the Rybczynski theorem under the conditions stated in the proposition. The condition will be met if the elasticities of factor substitution in sectors \( A \) is relatively small.

Now, let us look at the change in unemployment. Since the unit coefficient of labor in sector \( M(\hat{a}_{La}) \) is constant, it can be shown from the definition of \( \hat{\lambda} \) that
\[
\hat{\lambda} = \hat{L}_u - \hat{L}_m - \hat{a}_{La} + X_m \rightleftharpoons \hat{L}_u - \hat{X}_m. 
\]
Thus, we have the following proposition.

\[2\) Note that \( \lambda_{La} (1 + \lambda) \lambda_{La} / \hat{a}_{La} \) can be written as \( rK_j / w_L L_u > rK_j / w_L L_u \), where \( K_j \) and \( L_j \) are capital and labor employed in sector \( j \) (\( j = A \) and \( M \)).\]
Proposition 2: Tourism promotion increases the urban unemployed to employed ratio ($\lambda$). It also raises the level of unemployment ($L_u$) and the rate of unemployment ($L_u/L$).

This result is rather paradoxical since tourism promotion is expected to create employment (hence reducing unemployment). However, our result shows that tourism promotion increases the outputs of the tourism and manufacturing sectors, while it decreases that of the agricultural sector. The decrease in the rural wage rate induces the rural labor force to migrate to the urban area. All of the migrant workers cannot be employed in the urban manufacturing sector, and some workers will be unemployed. Thus, tourism promotion eventually increases unemployed to employed ratio, and it increases unemployment due to the unexpected resource allocation effect. The effects of the negative externality of pollution on the agricultural production boost resource allocation and exacerbate the problem of unemployment.

Next, let us investigate the implications of tourism promotion on welfare. The demand side of the model is represented by a quasi-concave social utility function ($U$). The social utility depends on the consumption demand for agricultural ($D_a$) and manufacturing ($D_m$) goods, and the level of pollution ($Z$). Thus,

$$U = U(D_a, D_m, Z),$$

where pollution has a negative effect on welfare, while the consumption of each good has a positive effect. The budget constraint of the economy is

$$D_a + p_mD_m = X_a + pM + p_aX_m - r*K^*.$$  

This implies that total expenditure is equal to total revenue. It is supposed that foreign factors remit their entire factor income ($r*K^*$) to their home country. Differentiating (24) and (25), and considering that $dX_a + (p_i - s)dX_t + p_mdX_m = -wL_md\lambda + g_F X_t$, and $p_m$ and $K^*$ are constant, we obtain

$$dU/U_a = dD_a + p_mdD_m - qdZ = -wL_md\lambda + (g' F + s - q)dX_t + X_t dp_m - K^* dr^*,$$

where $U_a = \partial U/\partial D_a > 0$ and $q = -\partial U/\partial Z)/U_a > 0$, express the marginal utility of an agricultural good and the marginal disutility of pollution, respectively.

Substituting (16), (18), (19) and (20) into (26), we have

$$dU/U_aT^* = \eta \pi \theta L_r & \sigma (wE + (s - q) \theta L_r X_t)/\Delta.$$  

Thus, the following proposition summarizes the result.

Proposition 3: Tourism promotion improves welfare if and only if $s > q + (-\xi)wL/\theta L_r X_t$.

Similar results have been obtained by Beladi et al. (2007), who used a model without unemployment, and Yabuuchi (2013), who did not consider the production externality. Therefore, our result extends theirs that tourism promotion improves welfare if $s > q$. The pollution tax must be higher for welfare improvement in the present case than that without negative production externality. Furthermore, our result is more pessimistic in the sense that unemployment increases in the labor market.

Tourism is also promoted if foreign country increases its investment to the tourism sector in the host country. This will happen, for example, a multinational hotel company decides to
establish its subsidiary in the country. This is captured by the increase in \( K^* \), and it has qualitatively similar effects on the outputs, unemployment and welfare of the host country.

4. Environmental Regulation and Tourism Promotion

It is natural to impose a pollution tax on the producer of the tourism good with the intention of reducing harmful effects on the economy. Tourism has two aspects, that is, a positive effect through improved employment, and a negative effect due to the production and consumption externalities. Thus, the introduction of a pollution tax has complicated effects on the economy. In this section, we examine the effects of a pollution tax on resource allocation, employment, and welfare.

As done in the previous section, we obtain the changes in variables as

\[
\dot{w}/s = \alpha\delta\hat{x}_{L}\sigma_{L}/\Delta > 0, \quad (28)
\]

\[
\dot{p}/s = \delta(1 + \gamma)\theta_{L}L\sigma_{L}/\Delta > 0, \quad (29)
\]

\[
\dot{X}/s = -\alpha\delta\hat{x}_{L}\sigma_{L}/\Delta < 0, \quad (30)
\]

\[
\hat{\lambda}/s = -\alpha\delta\hat{x}_{L}\sigma_{L}/\Delta < 0, \quad (31)
\]

\[
\hat{r}^*/s = \alpha\delta(\theta_{L} + \theta_{L}\sigma_{L})/\Delta > 0, \quad (32)
\]

\[
\dot{X}_{a}/s = \alpha\delta\sigma_{L}\theta_{L}(1 - \sigma_{a})(1 + \lambda)\lambda_{Km} - \lambda_{La}\lambda_{K}\theta_{La} + \xi\theta_{L}(\lambda_{Km} - \lambda_{La}\lambda_{La} + \lambda_{La}(1 + \lambda))]/\Delta, \quad (33)
\]

\[
\dot{X}_{m}/s = \alpha\delta\lambda_{La}\sigma_{L}\lambda_{La} - \theta_{L}\xi\lambda_{La}\sigma_{L} + (1 + \lambda)\lambda_{La}]/\Delta, \quad (34)
\]

Thus, a pollution tax has diametrically opposite effects on the variables. This can be interpreted as follows. The increase in the tax rate (\( s \)) naturally decreases the output of the tourism good. This has favorable effect on the demand for the good through the decrease in the pollution. Therefore, both the initial decrease in the production of the tourism good and the increase in the demand tend to increase the price. The negative externality due to the increase in the output of the tourism good must be adjusted by the decrease in the cost of production in the agricultural sector. Thus, this decreases the wage rate (\( w \)) under the constant domestic rental rate (\( r \)), in order to maintain the constant price of the agricultural good.

On the other hand, it can be seen from (31) and (32) that the pollution tax expand the agricultural sector if \( \sigma_{a} < 1 \), and it contracts the manufacturing sector. This implies that the contraction of the tourism good releases labor to the traditional sectors; hence, it increases the production of the labor-intensive agricultural sector, \( A \), and decreases the production of the capital-intensive sector, \( M \), under some plausible conditions, according to the Rybczynski theorem.

The results are summarized in the following proposition.

**Proposition 4**: A pollution tax decreases the output of the tourism good. It expands the agricultural sector if \( \sigma_{a} < 1 \), while it contracts the manufacturing sector.

Now, let us focus on the effect on unemployment. Note that the change in unemployment is equal to the change in the unemployed to employed ratio \( \lambda \) plus the change in output of sector \( M \). Thus, from (31), we have the following proposition.
Proposition 5: A pollution tax decreases the urban unemployed to employed ratio $(\lambda)$, and it also decreases the level of unemployment $(L_u)$ and the rate of unemployment $(L_u/L)$.

As shown above, the pollution tax decreases the outputs of the tourism and manufacturing sectors, while it increases that of the agricultural sector. The increase in the rural wage rate due to the tax induces the urban labor force to migrate to the rural area. Both employed and unemployed workers in the urban area will move to the rural area and employed there. Thus, the pollution tax eventually decreases unemployed to employed ratio, and it decreases unemployment due to the resource allocation effect.

Now, let us examine the implications of the pollution tax on welfare. Substituting (29) - (32) into (26), we have

$$
(D/\partial U_u)(dU/s) = \theta_L \sigma \left[ \alpha wL - pX(\alpha \theta_L - (1 + \gamma)\theta_L) - \alpha X(S - q)\theta_L \right] - \alpha \theta_L pK.*
$$

Thus, we have the following proposition.

Proposition 6: A pollution tax improves welfare if $s < q + \theta_L pK/\theta_L$.

Our result on welfare is rather restrictive compared with the conventional wisdom. The literature states that a pollution tax improves welfare if $s < q$. In the present model with unemployment and negative externalities in both production and consumption, the tax decreases unemployment through the Harris-Todaro labor allocation mechanism as well as the negative externality. This effect is captured by $-wLmd\lambda$ in (26). Furthermore, the price of the tourism good increases due to the contraction of the tourism sector, that is, the term of the trade effect is positive, as shown by $Xtdpt$. The positive effects of production and consumption externalities also appear as $g'F'dX$ and $-qdX$, respectively. All these positive effects are compared with the negative effect of tax revenue, $sdX$. Our result shows that a pollution tax improves welfare if the initial tax rate is considerably low, such that $s < q + \theta_L pK/\theta_L$. However, the possibility of welfare improvement is still high even if this condition is not satisfied because of other beneficial effects.

5. Concluding Remarks

Tourism is expected to increase employment and improve national welfare in labor-surplus developing economies. However, tourism promotion degrades and depletes the environment due to the pollution generated by the production of the tourism good and increase in the number of tourists. Thus, together, tourism promotion coupled with efforts towards environmental protection (in the form of a pollution tax) generates complicated effects on the economy. Thus, in this paper, we examined the interaction between tourism promotion (or control), the environment, unemployment, and welfare.

The main findings of this paper are that (i) tourism promotion expands the tourism sector, and increases unemployment, while an increase in the pollution tax contracts the tourism sector, and decreases unemployment, and (ii) tourism promotion improves welfare if the tax rate is sufficiently high, such that $s > q + (\xi)wL/\theta_L X$, while a pollution tax improves welfare if...
the tax rate is sufficiently low, such that \( s < q + p_i \xi_1 \theta_{K_i} / \theta_{L_a} \). Thus, our results indicate an important implication for the economy, namely, that pollution generated by tourism and allied activities has serious effects on agricultural production. Tourism promotion succeeds in expanding the tourism sector and may improve welfare at the risk of unemployment and agricultural production. The pollution tax, conversely, is likely to improve welfare by decreasing unemployment and the marginal disutility of pollution, and increasing the price of the tourism good, although not surprisingly, it decreases the output of the tourism sector. Thus, it would be prudent for policy makers to consider an appropriate mix of policies in order to promote tourism, reduce unemployment, and improve welfare.

Appendix

We assume the following adjustment mechanisms in the good and factor markets following Mayer (1974).

\[
\begin{align*}
X_t &= a_1 \{ p_t - (a_{L_a} t + a_{K_t} r^*) \}, \\
\dot{r}^* &= a_2 (a_{K_t} X_t - K^*),
\end{align*}
\]

(A1) (A2)

where \( \dot{\cdot} \) denotes differentiation with respect to time, and \( a_j \) is the positive coefficient measuring the speed of adjustment. We assume that there are no adjustment costs. Equation (A1) shows a Marshallian adjustment process with the output of the tourism good according as the demand price differs from the supply price (i.e., the average cost of producing the commodity). On the other hand, equation (A2) shows a Walrasian adjustment mechanism implying that the return will have to adjust in the foreign capital market.

The Jacobian matrix of the system of the simultaneous equations (A1) and (A2) is

\[
J = \begin{bmatrix}
(1 + \gamma) \theta_{L_a} & -\alpha \xi_1 \theta_{L_a} \\
\theta_{L_a} + \xi_1 \theta_{L_a} \sigma_i / \theta_{L_a} & -\xi_1 \theta_{L_a} \sigma_i, \end{bmatrix}
\]

(A3)

Thus, it can be seen that

\[
\begin{align*}
|J| &= -(p*K*/a_1) \{ [(1 + \gamma) \theta_{L_a} - \alpha \xi_1 \theta_{L_a}] \theta_{L_a} / \theta_{L_a} \sigma_i - \alpha \theta_{L_a} \theta_{K_t} \}, \\
&= -(p*K*/a_1) \Delta.
\end{align*}
\]

(A4)

According to the Routh–Hurwitz theorem, a necessary condition for local stability of the system is that \( |J| > 0 \). Thus, we assume that the equilibrium is stable, it can be seen that \( \Delta > 0 \) since \( \alpha < 0 \) by definition.

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