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Tourism, Capital / Labor Inflow, and Regional Development

Yuichi Furukawa Kenji Kondoh Shigemi Yabuuchi

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Yuichi Furukawa† Kenji Kondoh‡ Shigemi Yabuuchi§

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Abstract

We consider an open rural region of a developed country with two sectors: an environmentally sensitive agricultural industry and locally operated tourism, which generates pollution. We find that if residents' preference for environmentally unfriendly touristic service is small, introducing additional capital, labor, and tourists promoted by local government may harm residents' economic welfare. Even if tourism is environmentally friendly, we can assert that the inflow of capital or labor can still possibly have negative effects. On the other hand, if residents' preference for touristic service is large, increased tourists from outside may have positive effects.

Keywords: tourism, environmental pollution, remittance
JEL Classification: R23, Q56, F22

1 Introduction

It is widely known that tourism is almost the only solution for economic development, not only for lower developing countries, but also for rural regions in developed countries. Visitors who consume various goods and services at tourist spots spend a lot of money. They also help create job opportunities. We can see almost all countries worldwide are keen to attract tourists from abroad. One good example is the case of Japan. Due to great efforts by the Japanese government, the number of foreign visitors has been increasing drastically. The total number of foreign visitors to Japan was 10.4 million in 2013, 13.4 million in 2014, 19.7 million in 2015, and 24.0 million in 2016.

On the other hand, we need to remember that tourism often causes several difficult problems. The most serious problem is environmental pollution. Tourism will contaminate the air and water due to drainage from hotels and restaurants, garbage from

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†School of Economics, Chukyo University. 101-2 Yagotohonmachi, Showa-ku, Nagoya 466-8666, Japan.

‡School of Economics, Chukyo University. 101-2 Yagotohonmachi, Showa-ku, Nagoya 466-8666, Japan.

§Department of Economics, Aichi University. 4-60-6 Hiraike-cho, Nakamura-ku, Nagoya 441-8622, Japan.

sightseeing sites, and so on. Damage to the natural environment will surely have negative effects on the health of ordinary residents living in touristic areas, in addition to indirect negative effects, including negative externalities on the productivities of agricultural and fishery industries. Therefore, it is commonly recognized that establishing environmentally friendly tourism is a rather important subject. Nevertheless, due to fast population declines and lost economic prosperity, some of the rural areas or developing countries are rushing to expand tourism by introducing foreign capital (or domestic capital from outside the region), such as a globally networked hotel.

Several studies focus on the environment and tourism. Beladi et al. (2007) examine the effects of tourism on welfare and the environment applying a two goods model (one tradable good and one non-tradable good). They conclude that an exogenous tourism boom can harm the environment and lower domestic residents' welfare. Their model assumes that pollution has direct negative effects on residents' economic welfare and that the productivity of each good does not change. Yabuuchi (2012) examines the three-sided problem of combining tourism promotion with environmental protection and unemployment concerns simultaneously. He formulates a general equilibrium model with unemployment a la Harris-Todaro and a tourism sector that generates pollution. One of the main findings is that tourism promotion, which implies an increase in expenditure by foreign tourists, increases unemployment and improves welfare if the pollution tax imposed on producers in the tourism sector is higher than the marginal disutility of pollution. We must remark that he considers a small, open economy comprising three sectors: manufacturing, tourism, and agriculture. Additionally, the model assumes that both domestic residents and foreign tourists demand tourism goods (touristic services). Furthermore, this study also focuses only on the direct negative external effects of pollution on residents' economic welfare while the productivity of each good does not change. On the other hand, Yabuuchi (2015) examines the interaction between tourism and environmental protection by considering both production and consumption externalities, and obtains results similar to those of Yabuuchi (2012). Finally, Tetsu (2006) extends Hazari et al.'s (2003) study to also examine the effects of tourism promotion in an urban-rural general equilibrium model with four goods. His study also aimed to examine the economic effects of tourism promotion, but assumes that most domestic residents cannot afford to consume tourism due to poverty. The main result is that both tourism promotion policies by introduction of foreign capital and foreign tourists have positive effects on rural farmers, but negative effects on urban workers. Here, we note that his study does not consider pollution caused tourism.

In our study, we consider an open rural region of a developed country. Different from studies above, which focus on national economies, we focus on a small rural area in which an agriculture or fishery industry and locally operated tourism exist without a manufacturing sector. This setting considers only rural areas, and justifies ignoring the existence of unemployment. In terms of the local government's industrial promotion policies, we consider three possible scenarios. In the first, we consider the inflow of (foreign) capital, such that investment from outside the region intends to manage the tourism service sector with local (domestic) capital. But we reasonably assume that the total earnings of capital from outside should be remitted. Second, we consider that labor inflow from outside the region also follows the public strategies to solve the serious problem of depopulation in rural area. Third, we study the economic effects of increased tourists from outside. To distinguish the differences in the properties of tourists and immigrants, we assume that immigrants contribute productions and consume both agricultural goods and tourist services, as domestic residents do, while tourists only consume touristic services as temporary visitors. Different from Beladi et al. (2007) and Yabuuchi (2012), we here consider the negative externality of tourism only on the agricultural sector's productivity, and this indirect effect seems sufficient to express the negative side of pollution. We find that three policies may harm residents' economic welfare when residents' preferences for environmentally unfriendly touristic service is small. Paradoxically, we can assert that the inflow of capital or labor can still possibly have negative effects even when tourism is relatively environmentally friendly.

In Section 2, we present the Model. Section 3 is devoted to the analysis. We provide concluding Remarks in Section 4.

2 The Model

Let us consider a small open rural region in a developed country located somewhat far from an urban area with a large population. For example, we can imagine the Gargano and Salento peninsulas in Pouglia, Italy, which are on the frignes of Bari metropolitan city. We may consider the Atsumi and Shima peninsulas in Tokai area, Japan, which are the frontier districts of the large economic bloc of Nagoya. Due to the inferior location just outside of the traffic network of the core city, each area is not suitable for the manufacturing industry. Thus, in this district, we find that agriculture and tourism are the main industries.

We can consider the agricultural goods as tradable because those produced in suburban areas are exported to the urban area in a typical case. On the one hand, tourism, including hotel services and several other activities, is essentially a non-tradable industry. Put simply, agricultural goods are produced by labor input while tourism is managed by sector-specific capital and labor. Following Copeland and Taylor (1999), we reasonably assume that the agricultural sector' productivity depends on the environmental stock. Additionally, according to Yabuuchi (2015), we also assume that the expansion of tourism, which implies exploitation of large scale hotels, causes pollution, implying negative externalities on the environmental stock. We consider that in this area, depopulation is a rather serious problem, and introducing capital, labor, or tourists from outside is an urgent issue for industrial promotion.[1]

Assume that the tourism production function can be expressed as a Cobb-Douglas type, that is,

$$T = L_T^{\frac{1}{2}} (K + K^*)^{\frac{1}{2}}, \tag{1}$$

where T denotes the total supply of tourism services, L_T denotes the total amount of labor employed in tourism, K denotes the local capital input to tourism, and K^* denotes foreign capital (including domestic capital introduced from outside of this area) input to tourism. The production function of the agricultural sector is

$$A = \sqrt{E} L_A, \tag{2}$$

where A denotes output, E denotes environmental stock, and L_A denotes total amount of labor employed in the agricultural sector.

[1] We can consider that capital and labor from outside include both foreign and domestic (from other areas) input.

We assume that environmental pollution is a function of the magnitude of tourism,

$$Z = \lambda T, \tag{3}$$

where Z denotes the level of pollution and λ denotes the parameter that indicates the magnitude of pollution caused by one unit of tourism service. As we mention above, pollution damages environmental capital, that is,

$$E = \overline{E} - Z, \tag{4}$$

where $\overline{E}$ denotes the initial level of environmental stock without any pollution.

We assume perfect competition in both factor markets. Then, factor prices are equalized with the value of marginal products. Thus, the following conditions should be satisfied:

$$w = \frac{1}{2} p_T \left(K + K^*\right)^{\frac{1}{2}} L_T^{\frac{1}{2}}, \tag{5}$$

$$w = \sqrt{E}, \tag{6}$$

$$r = \frac{1}{2} p_T L_T^{\frac{1}{2}} \left(K + K^*\right), \tag{7}$$

where the price of agricultural goods is the numeraire, w denotes the wage rate, r denotes the rental price of capital, and p_T denotes the price of one unit of tourism service.

We can express the full employment condition for labor as

$$L \equiv L_T + L_A = \overline{L} + L_M, \tag{8}$$

where $\overline{L}$ denotes the initial level of labor endowment in this region and L_M denotes the inflow of foreign labor (including domestic workers from outside the region).

Let us also assume that the social utility function can be expressed as a Cobb-Douglas type, that is,

$$U = \alpha \log D_T + (1 - \alpha) \log D_A, \tag{9}$$

where U denotes social welfare, D_T denotes the aggregate demand for tourism services, D_A denotes aggregate demand for agricultural goods, and α denotes the parameter reflecting consumers' preference for tourism services. Tourism services are non-tradable and consumed within the region. Foreign capital owners are simply investors and are assumed to be free of consumption in this region. Thus, the total income of foreign capital should be remitted by agricultural goods. Additionally, we consider tourists from outside who are only temporary visitors and consume only touristic services in this region in our model.[2] Under the above scenario, we have

$$D_T = T - \beta, \tag{10}$$

$$D_A = A - rK^*, \tag{11}$$

[2]For example, the Tremiti islands located off the coast of the Gargano peninsula are touristic spots with beautiful beaches and historical heritage. Most of tourists who visit these islands are from the same region, Regione Pouglia. Some tourists are from Germany, where no tropical beach exists, but almost all of visitors are Italian. Similarly, most guests to the three Aichi islands (Shino-jima, Himaga-jima, and Saku-shima) are from the Tokai area. Tourists outside of the region are rare. In any case, tourists outside stay for relatively short periods.

where β denotes the exogenously given total amount of tourism services consumed by tourists visiting from outside the region (including foreign tourists). The budget constraint condition within this region is

$$P_T D_T + D_A = wL + rK. \tag{12}$$

Solving the welfare maximization problem for (9), subject to constraint (12), and considering (10) and (11), we obtain

$$p_T (T - \beta) = \alpha (wL + rK), \tag{13}$$

$$A - rK^* = (1 - \alpha)(wL + rK). \tag{14}$$

Note that we can exempt either equation (13) and (14) from Walras Law. Remembering the property of the Cobb-Douglas function, from equation (1), the distributive share between capital and labor is the same. Then, we have

$$r (K + K^*) = wL_T. \tag{15}$$

We now have 5 equations, (1), (5), (6), (7), and (13) that determine 5 endogenous variables, p_T, w, L_T, r, and T. Accordingly, L_A should be from (8), and A will be from (2). Finally, we obtain U from (9).

3 Analysis

In this section, we examine the effects of workers from outside, L_M, outside capital, K^*, and outside tourists, β. In doing this, we rewrite the five core equilibrium conditions as follows. From (1), (5), (6) (with (3), and (4)), (7), and (13) (with (8)), we have

$$\begin{aligned} T^2 &= L_T (K + K^*), && (1') \\ p_T^2 (K + K^*) &= 4w^2 L_T, && (5') \\ w^2 &= \overline{E} - \lambda T, && (6') \\ p_T^2 L_T &= 4r^2 (K + K^*), && (7') \\ p_T (T - \beta) &= \alpha[rK + w(\overline{L} + L_M)]. && (13') \end{aligned}$$

3.1 Equilibrium

In this case, the five conditions above determine (T, L_T, p_T, w, r). Since $L_T = T^2/(K+K^*)$ from (1'), we can rewrite (5') as follows:

$$p_T = \frac{2wT}{K + K^*}. \tag{16}$$

By (5') and (7'), or equivalently, by (15), we have

$$\frac{r}{w} = \frac{L_T}{K + K^*} = \left(\frac{T}{K + K^*}\right)^2, \tag{17}$$

in which the second equality comes from (1'). Substituting (15) and (16) into (13') yields a quadratic equation for T,

$$T^2 - \frac{2\beta (K + K^*)}{2(K + K^*) - \alpha K} T - \frac{\alpha (K + K^*)^2 (\overline{L} + L_M)}{2(K + K^*) - \alpha K} = 0. \tag{18}$$

Accounting for the usual non-negativity condition $T \geq 0$, the solution to (18) gives

$$T = \frac{K+K^*}{2(K+K^*)-\alpha K}\left[\beta+\sqrt{\beta^2+\alpha\left(2\left(K+K^*\right)-\alpha K\right)\left(\overline{L}+L_M\right)}\right] \equiv T(\underset{+}{L_M}). \quad (19)$$

Using (19) for (6'), we obtain

$$w = \sqrt{\overline{E}-\lambda T(L_M)} \equiv w(\underset{-}{L_M}). \quad (20)$$

Therefore, we can express (1') as

$$L_T = \frac{T(L_M)^2}{K+K^*} \equiv L_T(\underset{+}{L_M}) \quad (21)$$

and (5') as

$$p_T = \frac{2T(L_M)}{K+K^*}\sqrt{\overline{E}-\lambda T(L_M)} \equiv p_T(L_M), \quad (22)$$

which uses (6').

Before proceeding, we note three important properties of the endogenous variables in equilibrium. As we showed, first,

- an increase in the inflow of workers from outside, L_M, results in an expansion of the tourism sector, i.e., increases in T and L_T. However, it causes environmental externalities and decreases agricultural labor productivity $\sqrt{E}$, and thereby the wage rate, w.

Then, the effect of an increase in L_M on the price of tourism services is more complex. It directly reduces the price of tourism services, p_T, due to the lower w, which results from our assumption of the external effect of tourism. However, it also increases the domestic demand for tourism T, which has an additional general-equilibrium effect of raising price p_T. Therefore, the total effect of outside workers, L_M, may be ambiguous. Specifically,

- as the inflow of workers from outside, L_M, increases (from 0), the two effects interact to first raise the price of tourism services, p_T, which then becomes a decrease if the external effect of tourism λ is sufficiently small to satisfy

$$\lambda < \frac{2}{3}\frac{2-\alpha K/\left(K+K^*\right)}{\beta+\sqrt{\beta^2+\alpha\overline{L}\left(2\left(K+K^*\right)-\alpha K\right)}}\overline{E} \equiv \lambda_+. \quad (23)$$

Otherwise, that is, if the damage tourism causes is more serious, with a larger λ, the negative externality simply dominates, because of which p_T monotonically decreases with L_M.[3]

[3] The proof is straightforward. Substituting (19) into (22) results in

$$p_T = \frac{2\zeta}{2\left(K+K^*\right)-\alpha K}\sqrt{\overline{E}-\frac{\zeta\lambda\left(K+K^*\right)}{2\left(K+K^*\right)-\alpha K}},$$

where

$$\zeta \equiv \beta+\sqrt{\beta^2+\alpha\left(2\left(K+K^*\right)-\alpha K\right)\left(\overline{L}+L_M\right)}.$$

Noting (21) and (22), (7') becomes

$$r = \left(\frac{T(L_M)}{K+K^*}\right)^2 \sqrt{\overline{E} - \lambda T(L_M)}. \tag{24}$$

We can easily verify that the rental price of capital r is increasing (decreasing) in $T(L_M)$ if $\frac{4}{5}\frac{\overline{E}}{\lambda} > (<) T(L_M)$. Since this inequality holds for $L_M = 0$ if the negative external effect of tourism, λ, is small so as to satisfy (23),

- an increase in L_M can have an inverted U-shaped effect on the price of capital, r, if λ is small enough to meet (23). Otherwise, that is, if λ is large so as to violate (23), the negative external effect dominates, because of which r is monotonically decreasing in $L_M \geq 0$.[4]

3.2 Effects of External Workers

From (10), (11), and (14), we can write the demand for T and A by native inhabitants as

$$\tilde{D}_T = \frac{\alpha\left(rK + w\overline{L}\right)}{p_T} \text{ and } \tilde{D}_A = (1-\alpha)\left(rK + w\overline{L}\right). \tag{25}$$

Define $\tilde{\alpha} = \alpha \log \alpha + (1-\alpha)\log(1-\alpha)$. From (9) and (25), the indirect utility for native residents can be reduced to a function in T as

$$\begin{aligned} \tilde{U} &= \log\left(rK + w\overline{L}\right) - \alpha \log p_T + \tilde{\alpha} \\ &= \frac{1-\alpha}{2}\ln\left(\overline{E} - \lambda T\right) + \ln\left(K\left(\frac{T}{K+K^*}\right)^2 + \overline{L}\right) - \alpha \ln\left(\frac{2T}{K+K^*}\right) + \tilde{\alpha}, \end{aligned} \tag{26}$$

which uses (20), (22), and (24). In the following, we will see the effects of L_M on $\tilde{U}$. There are two channels through which T affects $\tilde{U}$. (i) Tourism T causes negative environmental externalities that reduce agricultural productivity A, yielding a lower wage rate w. This effect is captured by the first and third terms on the right-hand side of (26). (ii) Lower factor prices lower the price of tourism services p_T, which positively affect $\tilde{U}$, captured by the second term. Due to these opposite effects, the effect of tourism T on native residents' welfare is not so obvious.

Note that $\tilde{U}$ in (26) does not include any explicit term on L_M. Hence, it would suffice to examine the effects of L_M via changes in T. That is, $\tilde{U}$ is increasing in L_M if and only if $\tilde{U}$ is increasing in T, given that T is increasing in L_M from (19). By differentiating $\tilde{U}$ with respect to T, we have

$$\frac{d\tilde{U}}{dT} = \frac{1}{T}\left[-\frac{1-\alpha}{2}\frac{\lambda T}{\overline{E} - \lambda T} + 2\frac{KT^2}{KT^2 + \overline{L}\left(K+K^*\right)^2} - \alpha\right]. \tag{27a}$$

Differentiating p_T with respect to ζ, we can show that $\frac{dp_T}{d\zeta} > 0$ if and only if

$$\overline{E} > \frac{3}{2}\frac{\lambda\left(K+K^*\right)}{2\left(K+K^*\right) - \alpha K}\zeta.$$

This can hold (even for $L_M = 0$) if the left-hand side in this inequality is higher than the lower bound of ζ due to $L_M \geq 0$; i.e., if (23) holds.

[4] In this case, $\frac{2}{3}\frac{\overline{E}}{\lambda} < T(L_M)$ holds for any $L_M \geq 0$.

We thereby verify that

$$\frac{d\tilde{U}}{dT} > 0 \Longleftrightarrow \frac{2KT^2}{KT^2 + (K + K^*)^2 \overline{L}} > \frac{1-\alpha}{2} \frac{\lambda T}{\overline{E} - \lambda T} + \alpha \tag{27b}$$

The following two lemmas characterize the effect of external workers L_M on native residents' welfare $\tilde{U}$.

Lemma 1 *Suppose α is sufficiently small. Welfare for native inhabitants $\tilde{U}$ increases (decreases) with the number of outside workers, L_M, as*

$$\lambda < (>) \frac{4\beta K}{5\beta^2 K + (K + K^*)^2 \overline{L}} \overline{E}. \tag{28}$$

Proof. See Appendix. ■

When λ is larger (i.e., when the negative external effect of tourism is stronger), as mentioned above, (23) is more likely to hold: an increase in L_M tends to decrease factor prices w and r. It reduces the incomes of native inhabitants and their welfare $\tilde{U}$. However, if λ is smaller, an increase in L_M expands the domestic demand more significantly, so it can increase the capital price r. In this case, the positive effect of increasing r (based on the demand side) can dominate the negative effect of decreasing w (based on the supply side), whereby the increase in L_M can have a positive effect on $\tilde{U}$.

When λ is smaller, the demand-increasing effect of L_M becomes more dominant. In such case, whether α is large or small, the effect of external workers L_M can be nonlinear. Intuitively, these nonlinearities arise from, again, the interaction between the direct price effect of L_M (in decreasing w) and the demand-expanding effect (in increasing r).

Lemma 2 *Suppose the population size for domestic inhabitants, $\overline{L}$, is sufficiently small. The welfare of native inhabitants first increases and eventually decreases as the number of external workers, L_M, increases if*

$$\lambda < 3\lambda_+ \left(\frac{2-\alpha}{5-3\alpha} \right). \tag{29}$$ [5]

Proof. See Appendix. ■

3.3 Effects of External Tourists

As (19) shows, naturally, the equilibrium output of tourism services, T, is an increasing function in the number of tourists from outside, β. That is, we may rewrite T as $T = T(L_M, \beta)$. Since, by (21), the equilibrium labor input for tourism L_T increases with T and does not depend directly on β, L_T, is also an increasing function in β in equilibrium;

[5] Note that (29) holds so long as (23) holds. This implies that the inverted U-shaped effect of outside workers L_M on welfare can be attributed , at least partially, to the inverted U-shaped effect of L_M on p_T.

$L_T = L_T(L_M, \beta)$. Both functions, T and L_T, are increasing in both arguments, L_M and β. From (2), (3), (4), and (8), we then derive the total output of an agricultural good as

$$A = \sqrt{\overline{E} - \lambda T(L_M, \beta)}\left(\overline{L} + L_M - L_T(L_M, \beta)\right). \tag{30}$$

This implies that tourists from outside, β, as well as external workers, L_M, have a negative effect on agriculture, A, via the increase in T (which causes pollution) and the increase in L_T (which leads to a shift in labor resources from agriculture L_A to tourism L_T).

Both outside tourists and workers encourage tourism T, but discourage agriculture A in equilibrium. However, the magnitudes of these effects vary. On the one hand, from (19), the positive effect of β on the tourism T can be either weaker or stronger than that of L_M. Specifically, the effect of β is stronger, i.e., $\partial T/\partial \beta > \partial T/\partial L_M$, if and only if the sum of β and L_M is sufficiently large to satisfy

$$\beta + L_M + \overline{L} > \alpha\left(2\left(K + K^*\right) - \alpha K\right)/4.^6 \tag{31}$$

This implies that in a region with more people (larger $\beta + L_M + \overline{L}$), an increase in tourists β encourages tourism T more significantly than it does for workers L_M. If the region has fewer people, a more effective effective way of encouraging tourism is to increase the number of external workers, rather than to attract more tourists.

The negative effect of β on agriculture A, on the other hand, is always stronger than that of L_M, as (30) shows, since a larger L_M has another positive effect due to a more abundant domestic production factor, $\overline{L} + L_M$, as the right-hand side of (30) shows. Therefore, one might think that external tourists β is more likely to negatively affect the equilibrium welfare $\tilde{U}$ under (31). This should be more likely when the consumption share for agricultural good A, $1-\alpha$, is larger (or equivalently, α is smaller). In fact, when α is small, the welfare effect of β tends to be basically negative. Formally, we have the following lemma.

Lemma 3 *Suppose α is sufficiently small. Native inhabitants' welfare, $\tilde{U}$, decreases with the number of outside tourists, β, if*

$$\lambda > \frac{\overline{E}}{K + K^*}\sqrt{\frac{4}{5}\frac{K}{\overline{L}}}. \tag{32}$$

Otherwise, the effect of β on $\tilde{U}$ is an inverted-N shape; $\tilde{U}$ first decreases, then increases, and finally decreases again as β rises.

Proof. See Appendix. ■

In the case of a larger α (a larger consumption share for T), one could suspect that the positive effect of β on T would tend to dominate the negative effect on A. In fact, the following lemma shows that native inhabitants' welfare, $\tilde{U}$, mostly increases with β.

Lemma 4 *Suppose α is sufficiently large. Welfare for native inhabitants $\tilde{U}$ monotonically increases with the number of outside tourists, β, if*

$$\frac{L_M}{K^*} > 2\frac{\overline{L}}{K}. \tag{33}$$

Otherwise, the effect of β on $\tilde{U}$ is U-shaped: $\tilde{U}$ first decreases and then increases as β rises.

[6] We derive this by differentiating (19) with respect to β and L_M.

Proof. See Appendix. ■

3.4 Effects of External Capital

In this section, we examine the welfare effects of an increase in external capital K^*. By (19) and (26), external capital K^* has a complex effect on $\tilde{U}$. First, it affects $\tilde{U}$ through a change in the size of tourism sector T. Then, by (22) and (24), an increase in K^* results in a decrease in its price r due to the usual price effect, thereby decreasing the price of tourism services p_T. The former effect positively influences $\tilde{U}$, and the latter does so negatively. The following lemma formally characterizes this complex effect of external capital K^*.

Lemma 5 *When α is sufficiently small, an increase in K^* leads to a decrease in native inhabitants' welfare $\tilde{U}$.*

Proof. See Appendix. ■

Lemma 5 states that for regions where native people have weaker preferences for local tourism (small α), outside capital K^* always harms native inhabitants. A critical effect is that a larger K^* lowers the factor income $rK + w\overline{L}$, by decreasing r and w. Meanwhile, a larger K^* could also decrease the price of tourism services p_T and expand the tourism sector T, both of which positively affect $\tilde{U}$. However, if local tourism has a smaller utility for native inhabitants (i.e., if α is smaller), these two positive effects become weaker. Therefore, the effect of decreasing factor incomes dominates: native welfare $\tilde{U}$ is a decreasing function in external capital K^*. This dominant-negative effect of external capital K^* is robust, even if the tourism sector is highly environmentally friendly ($\lambda = 0$).

Now we establish the following Proposition.

Proposition 1 *Consider a rural region with an economy that depends on two industries, agriculture and tourism. Agricultural goods are tradable and produced by labor. Their productivity depends on the environmental stock. Tourism services are produced by factor-specific capital and labor, are non-tradable, and generate pollution, which has negative effects on the environmental stock. Then, we can assert the following four statements:*

1. *Introducing additional labor L_M from outside the region has negative (positive) effects on the economic welfare $\tilde{U}$ of native inhabitants if residents' preferences for tourism services α is sufficiently small and the negative external effect on the environment caused by tourism λ is larger (smaller).*

2. *When the population size $\overline{L}$ of native inhabitants is sufficiently small, their welfare $\tilde{U}$ first increases and eventually decreases as the number of external workers L_M increases if the negative external effect on the environment caused by tourism λ is smaller.*

3. *Introducing additional tourists β from outside the region mostly causes negative (positive) effects on the economic welfare $\tilde{U}$ of native inhabitants if residents' preferences for tourism services α is sufficiently small (large).*

4. *Introducing additional capital K^* from outside the region also has negative effects on the economic welfare $\tilde{U}$ of native inhabitants if residents' preferences for tourism services α* is sufficiently small.

Proof. It would suffice to apply Lemmata 1 and 2 for the first two statements, Lemmata 3 and 4 for the third, and Lemma 5 for the last one. ■

4 Concluding Remarks

The results above are in contrast to those of Kondoh (1999), who applies two-goods two-factor model. Kondoh (1999) also assumes that one of the two goods is non-tradable, but applies the ordinary Heckscher-Ohlin model in which two factors, capital and labor, should be indispensable for the production of both goods. In addition, he does did not consider the negative externality of environmental pollution. Under the above assumptions, introducing additional capital or labor from outside is beneficial for native inhabitants. Our study suggests the possibility of a different scenario considering the more realistic situations of rural areas.

The Proposition says that rural areas might lose from the introduction of capital, labor, and tourists from outside if tourism is not environmentally friendly and residents' preferences for tourism services is small. In our model, the total income of foreign capital should be remitted externally and the amount will increase due to an increase in labor as well as capital inflow. This is the main reason for the reduction in total incomes and economic welfare for native residents. Another reason is that introducing capital/labor from outside, through expanding the tourism sector, increases the levels of environmental pollution, which harms agriculture and has a negative effect on native residents' economic welfare. When native inhabitants have weaker preferences for tourism, these two negative effects tend to be stronger.

We can obtain similar results even when tourism is environmentally friendly. Introducing a large magnitude of workers from outside may harm native residents' welfare when the local native population size is small. Moreover, capital inflow still causes negative effects when residents' preferences for tourism services is small.

Finally, in our model, increased tourists from outside who consume only tourism services enhance residents' economic welfare when tourism is environmentally friendly and native inhabitants have a high preference for tourism. This result may also look curious because tourists rather than residents consume tourism services. However, tourism does not contribute to production. Therefore, this seems to reduce the total amount of tourism services reserved for natives and their economic welfare also seems to decrease. Nonetheless, we need to remember that a large amount of the remittance is the main reason for the decrease in welfare. It will become clear and reasonable to consider that by increasing tourists from outside, the remittance of foreign capital will decrease more in the case of environmentally friendly tourism with a high remittance.

Summarizing all results above, in order to carry out economic development in a region with poor capital endowment, local governments should consider promoting tourism by introducing capital and/or labor, but by attracting tourists from outside especially if native people prefer tourism enough. It is also worth noting that even if it is highly environmentally friendly, promoting tourism can occasionally reduce native inhabitants' welfare.

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Appendix

Proof of Lemma 1. From (19), $T \to \beta$ as $\alpha \to 0$. Using (27a), we have

$$\lim_{\alpha \to 0}\left(\frac{d\tilde{U}}{dT}\right) = -\frac{1}{2}\frac{\lambda}{\overline{E}-\lambda\beta} + \frac{2K\beta}{K\beta^2 + \overline{L}\left(K+K^*\right)^2}, \tag{A1}$$

with which we can show $\frac{d\tilde{U}}{dT} > 0$ if and only if (28) holds. ■

Proof of Lemma 2. First, note that

$$\frac{2}{3}\frac{\overline{E}}{\lambda_+} \leq T < \frac{\overline{E}}{\lambda}, \tag{A2}$$

in which the first inequality comes from $L_M \geq 0$, with (19) for the expression of T and (23) for the definition of λ_+, and the second inequality from $w > 0$. These bounds of T have upper and lower bounds of L_M, given that T is monotonically increasing in L_M.

In a region sufficiently close to the upper bound in (A2), on the one hand, (27b) is necessarily violated since $1/(\overline{E} - \lambda T)$ goes for ∞, that is, $\frac{d\tilde{U}}{dT} < 0$ holds for a sufficiently large T (and thus a sufficiently large L_M since T is increasing in L_M). On the other hand, in a region in which T is sufficiently close to its lower bound, (27b) converges to

$$\frac{8K\overline{E}^2}{4K\overline{E}^2 + 9\lambda_+^2\left(K+K^*\right)^2\overline{L}} > \frac{(1-\alpha)\lambda}{3\lambda_+ - 2\lambda} + \alpha. \tag{A3}$$

Taking $\overline{L} \to 0$, this converges to

$$\lambda < 3\lambda_+\left(\frac{2-\alpha}{5-3\alpha}\right). \tag{A4}$$

■

Proof of Lemma 3. Since $\tilde{U}$ in (16) does not have any explicit term for the demand for tourism services by outside tourists and, at the same time, the equilibrium output of tourism services T is monotonically increasing in β, we can hence apply (28) to the effect of β; $d\tilde{U}/d\beta > (<) 0$ if and only if $\beta \notin B \equiv (B_-, B_+)$, where

$$B_- \equiv \frac{2K\overline{E}}{5\lambda K}\left[1 - \sqrt{1 - \frac{5}{4}\left(\frac{\lambda(K+K^*)}{\overline{E}}\right)^2\frac{\overline{L}}{K}}\right] \text{ and } B_+ \equiv \frac{2K\overline{E}}{5\lambda K}\left[1 + \sqrt{1 - \frac{5}{4}\left(\frac{\lambda(K+K^*)}{\overline{E}}\right)^2\frac{\overline{L}}{K}}\right]. \tag{A5}$$

This implies that as β increases (from 0), $\tilde{U}$ first decreases for $\beta < B_-$, then increases for $\beta \in B$, and finally decreases again for $\beta > B_+$; there is an inverted N-shaped effect of β on $\tilde{U}$. Also note that the interval B is empty if and only if

$$\lambda > \frac{\overline{E}}{K+K^*}\sqrt{\frac{4}{5}\frac{K}{\overline{L}}},$$

under which $d\tilde{U}/d\beta < 0$ always holds. ■

Proof of Lemma 4. Define $\tau \equiv \lim_{\alpha \to 1} T = \frac{K+K^*}{K+2K^*}\left[\beta + \sqrt{\beta^2 + (K+2K^*)\left(\overline{L} + L_M\right)}\right] > 0$. Then, by (19) and (27),

$$\lim_{\alpha \to 1}\frac{d\tilde{U}}{dT} = \frac{1}{\tau}\left[\frac{K\tau^2 - \overline{L}\left(K+K^*\right)^2}{K\tau^2 + \overline{L}\left(K+K^*\right)^2}\right]. \tag{A6}$$

Accordingly, $\lim_{\alpha\to 1}(d\tilde{U}/dT) > 0$ if and only if $\tau > (K+K^*)\sqrt{\overline{L}/K}$, which is equivalent to

$$\beta + \sqrt{\beta^2 + (K+2K^*)\left(\overline{L}+L_M\right)} > (K+2K^*)\sqrt{\overline{L}/K}. \tag{A7}$$

Note that (A7) always holds for any $\beta \geq 0$ if (33) holds. If (33) does not hold, there is a threshold value of β above (under) which (A7) holds (does not hold). ■

Proof of Lemma 5. From (19), we can calculate

$$\begin{aligned}
&\frac{dT}{dK^*} \qquad\qquad \text{(A8)}\\
&= \left\{\left(\tfrac{K+K^*}{2(K+K^*)-\alpha K}\right)'\left[\beta+\sqrt{\beta^2+\alpha\left(2\left(K+K^*\right)-\alpha K\right)\left(\overline{L}+L_M\right)}\right] + \tfrac{K+K^*}{2(K+K^*)-\alpha K}\tfrac{1}{2}\tfrac{2\alpha\left(\overline{L}+L_M\right)}{\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}}\right\}\\
&= \left\{-\tfrac{\alpha K\left[\beta+\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}\right]}{\left(2(K+K^*)-\alpha K\right)^2} + \tfrac{K+K^*}{2(K+K^*)-\alpha K}\tfrac{\alpha\left(\overline{L}+L_M\right)}{\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}}\right\}
\end{aligned}$$

and

$$\begin{aligned}
&\frac{d}{dK^*}\left(\frac{T}{K+K^*}\right) \qquad\qquad \text{(A9)}\\
&= \left\{\left(\tfrac{1}{2(K+K^*)-\alpha K}\right)'\left[\beta+\sqrt{\beta^2+\alpha\left(2\left(K+K^*\right)-\alpha K\right)\left(\overline{L}+L_M\right)}\right] + \tfrac{1}{2(K+K^*)-\alpha K}\tfrac{\alpha\left(\overline{L}+L_M\right)}{\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}}\right\}\\
&= \left\{-\tfrac{2\left[\beta+\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}\right]}{\left(2(K+K^*)-\alpha K\right)^2} + \tfrac{1}{2(K+K^*)-\alpha K}\tfrac{\alpha\left(\overline{L}+L_M\right)}{\sqrt{\beta^2+\alpha(2(K+K^*)-\alpha K)\left(\overline{L}+L_M\right)}}\right\}.
\end{aligned}$$

These two expressions imply

$$\lim_{\alpha\to 0}\left(\frac{dT}{dK^*}\right) = 0 \text{ and } \lim_{\alpha\to 0}\left(\frac{d}{dK^*}\left(\frac{T}{K+K^*}\right)\right) = -\frac{\beta}{\left(K+K^*\right)^2}. \tag{A10}$$

Finally, we slightly rewrite (26) as follows:

$$\tilde{U} = \frac{1-\alpha}{2}\ln\left(\overline{E}-\lambda T\right) + \ln\left(K\left(\frac{T}{K+K^*}\right)^2 + \overline{L}\right) - \alpha\ln\left(\frac{T}{K+K^*}\right) - \alpha\ln 2.$$

Differentiating this with respect to K^* yields the following calculations:

$$\begin{aligned}
\frac{d\tilde{U}}{dK^*} &= \tfrac{1-\alpha}{2}\tfrac{d\ln\left(\overline{E}-\lambda T\right)}{dT}\tfrac{dT}{dK^*} + \tfrac{d\ \ln\left[K\left(\frac{T}{K+K^*}\right)^2+\overline{L}\right]}{d\left(\frac{T}{K+K^*}\right)}\tfrac{d}{dK^*}\left(\tfrac{T}{K+K^*}\right) - \tfrac{d\ \left[\alpha\ln\left(\frac{T}{K+K^*}\right)\right]}{d\left(\frac{T}{K+K^*}\right)}\tfrac{d}{dK^*}\left(\tfrac{T}{K+K^*}\right)\\
&= -\tfrac{1-\alpha}{2}\tfrac{\lambda}{\overline{E}-\lambda T}\tfrac{dT}{dK^*} + \tfrac{2K\left(\frac{T}{K+K^*}\right)}{K\left(\frac{T}{K+K^*}\right)^2+\overline{L}}\tfrac{d}{dK^*}\left(\tfrac{T}{K+K^*}\right) - \tfrac{\alpha}{\left(\frac{T}{K+K^*}\right)}\tfrac{d}{dK^*}\left(\tfrac{T}{K+K^*}\right),
\end{aligned}$$

which becomes

$$\frac{d\tilde{U}}{dK^*} = -\frac{1-\alpha}{2}\frac{\lambda}{\overline{E}-\lambda T}\frac{dT}{dK^*} + \left[\frac{2K\left(\frac{T}{K+K^*}\right)^2}{K\left(\frac{T}{K+K^*}\right)^2+\overline{L}} - \alpha\right]\frac{\frac{d}{dK^*}\left(\frac{T}{K+K^*}\right)}{\left(\frac{T}{K+K^*}\right)}. \tag{A11}$$

From (A10) and (A11), we obtain

$$\lim_{\alpha \to 0} \left(\frac{d\tilde{U}}{dK^*} \right) \to -\frac{1}{K + K^*} \frac{2\beta^2 K}{\beta^2 K + \overline{L} \left(K + K^* \right)^2} < 0, \tag{A12}$$

in which we use $\frac{T}{K+K^*} \to \frac{\beta}{K+K^*}$ as $\alpha \to 0$. ■