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Abstract

This study examines the effects of policy changes and improvements in the agritourism sector in a developed country with free trade and capital movement. The country comprises two regions: an urban area where the manufacturing sector is located, and a rural area where both the agricultural and agritourism sectors are located. We consider free labor mobility between the two areas and the structural, frictional unemployment in the urban area. We demonstrate that if agritourism is environmentally friendly and the domestic preference for manufactured goods is sufficiently large, labor inflow to this country, a reduction in the ratio of agricultural goods to touristic services in the agritourism sector, an enhancement of labor productivity in the tourism sector, and technological improvements related to environmental protection in either the manufacturing or agritourism sector will enhance the natural environment, the rural wage rate, and domestic welfare, and will reduce the urban unemployment rate and urban–rural wage gap.

Keywords: Agritourism, Urban–rural migration, Unemployment

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1. Introduction

Agritourism is a new type of tourism that involves both the agricultural and tourism industries. Typically, it involves an agricultural environment that attracts visitors for agricultural operations, recreation, entertainment, and/or educational experiences.[1] Agritourism is widely believed to be beneficial to producers and communities. Farmers take advantage of the opportunities available to generate additional income and obtain a direct marketing channel to consumers, whereas the tourism industry benefits from the increase in the number of visitors and their length of stay. Unlike ordinary tourism, which sometimes harms the natural environment, agritourism may offer an environmentally friendly atmosphere where visitors can enjoy experiences such as planting, harvesting, and feeding. Moreover, agritourism business may contribute to expanding job opportunities in rural areas, and the enhanced national income will improve domestic welfare.

Whereas agritourism is widespread in Asian developing countries such as Thailand, the Philippines, and Cambodia, it is still mainly witnessed in developed countries, such as the United States and EU countries. There are several important differences in the status of agritourism and economic structures between developed and developing countries.

First, in developing countries, the agritourism sector mainly targets foreign visitors from rich countries. The services in this sector are not intended for poor domestic residents. For example, Thailand offers foreign visitors several agritourism trips, which include visits to fruit farms and farmers' houses, harvesting and cooking experiences, and the opportunity to enjoy traditional foods served by English-speaking local guides.[2] However, in developed countries, agritourism is focused primarily on domestic tourists. This implies that the total output of agritourism directly reflects the welfare of domestic residents who consume the services in this sector.

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[1] For example, the National Agricultural Law Center (https://nationalaglawcenter.org/) reports that pumpkin picking patches, corn mazes, U-Pick operations, petting and feeding zoos, hayrides, cut-your-own Christmas tree farms, dude ranches, demonstration farms, agricultural museums, living history farms, on-farm farmers' markets, winery tours and wine tastings, rural bed and breakfasts, and garden tours are conducted in the United States.

[2] Responsible Thailand (www.responsiblethailand.co.uk/).

Second, as developing countries with low capital–labor ratios tend to have low wage levels, international labor outflow will occur if permitted. The remittance from emigrants plays an important role in the economic development of developing countries.[3] Thus, governments in developing countries seem to permit such international labor outflow in most cases. Additionally, in developing countries, as Harris and Todaro (1970) formalized, there exist urban–rural migration and urban unemployment caused by fixed high wage rates in urban areas. Additionally, domestic capital in developing countries is quite scarce. Thus, governments in developing countries often earnestly try to introduce foreign direct investment. It should be noted that in some least developed countries, almost all of the capital is owned by foreign investors; thus, capital income does not contribute to the national income of the developing country.

In this study, we focused on the economies of developed countries with agritourism sectors. As the capital/labor ratio is relatively high, developed countries export capital under free capital mobility. All of the capital income of the manufacturing sector in developed countries contributes to the national income of the respective country. The labor market is also different. It is natural and realistic to consider that the urban wage rate is flexible, but structural frictional unemployment exists in urban areas, which causes a wage gap between urban and rural areas. In rural areas, similar to in developing countries, we can reasonably assume full employment.

This study aims to examine the effects of different policies in a developed country with an agritourism sector compared with cases in a developing country studied by Kondoh and Kurata (2021). We investigate the effects of an exogenous change in the labor supply caused by international immigration. In addition, we consider the effects of changes in the agritourism industry, focusing on an increase in labor productivity, a shift to agricultural-goods-intensive tourism, and more environmentally friendly agritourism.

In this study, similar to Kondoh and Kurata (2021), we analyze the economy, which consists of two regions: an urban area where the manufacturing sector is located and which has a certain level of structural frictional unemployment, and a rural area where both the agricultural and agritourism sectors are located. Labor is a necessary input for every sector, whereas domestic capital investment is a specific factor of production for the manufacturing of goods. The agritourism sector is supposed to supply a combined good whose primary components are touristic services (also supplied by labor input) and agricultural goods. The productivity of agricultural goods depends on the stock level of environmental capital, which can be damaged by the manufacturing sector but helped by agritourism. As our study focuses on the economy of a

[3] Meyer and Shera (2017) empirically tested the impact of remittances on economic growth, using the data of six high-remittance-receiving countries. They showed significant relationships between remittance and economic growth in these countries.

developed country, different from Kondoh and Kurata (2021), we assume the existence of 1) domestic capital owners, 2) free capital mobility, 3) free trade, and 4) domestic consumption of all three types of goods: manufacturing, agricultural, and agritourism.

The main results of our study are as follows. If agritourism is environmentally friendly and the domestic preference for manufactured goods is sufficiently large, labor inflow to this country, a reduction in the ratio of agricultural goods to touristic services in the agritourism sector, an enhancement of labor productivity in the tourism sector, and technological improvements related to environmental protection in either the manufacturing or agritourism sector will enhance the natural environment, the rural wage rate, and domestic welfare, and will reduce the urban unemployment rate and urban–rural wage gap.

On several points, the above conclusions differ from those of Kondoh and Kurata (2021), who studied the case of a developing country. As opposed to our intuitions, this study shows that labor inflow has positive effects on the wage rate of workers in the rural area. This is because immigration causes no change in the magnitude of the manufacturing sector and due to the reduced international trade caused by increased domestic demand on manufactured goods, employment in the rural area will increase in order to compensate for decreased import of agricultural goods. The expansion of environmentally friendly agritourism helps reduce pollution and causes positive effects on the stock of natural environment which directly connected with the wage rate in the rural area just equal to the productivity of the agricultural sector. The effects of the improvement in the agritourism sector are similar to those found by Kondoh and Kurata (2021), but both the urban wage rate and unemployment rate are endogenously determined in this study.

Before proceeding, we discuss the relationship between this study and existing studies. We can categorize studies on agritourism into three major groups. The first group, which includes Galuzzo (2018) and McGehee and Kim (2004), defines the properties of agritourism by focusing on the incentives of the supply side of starting a business. The second group, which includes Carpio et al. (2008), Santeramo and Barbieri (2017), and Sidali et al. (2019), investigates the incentives of the demand side, such as tourists' preferences and properties. Finally, the third group, which includes Jeczmik et al. (2015), Maude and van Rest (1985), Schilling et al. (2012), and Kondoh and Kurata (2021), studies the economic effects of agritourism and considers several specific aspects such as natural environmental protection, the income growth of the rural population, and labor mobility. It is important to note that most of the studies in this group are empirical and include case studies in countries such as the United States, the United Kingdom, and Italy, while only a few theoretical studies have been carried out.

Regarding the environmental protection aspects, several theoretical studies have focused on the economic effects of tourism promotion. Following the pioneering study by Copeland (1991), most recent studies, including those of Beladi et al. (2009), Chao and Sgro (2008), Chao et al.

(2004, 2008, 2010), Hazari and Hoshmand (2011), and Yanase (2017), have used a trade model to investigate the agritourism industry. Furukawa et al. (2019) focus on a rural area in a developed country and study the effects of the inflow of capital, labor, and tourists from outside the area. Yabuuchi (2013, 2015) studies the economic effects of tourism promotion in developing countries by applying an extended urban–rural migration model by Harris and Todaro (1970). These studies investigate the combined effects of tourism promotion and environmental protection prompted by a pollution tax, considering production and consumption externalities.

We need to state that theoretical studies focusing on the effects of economic policies under the existence of an agritourism sector are not sufficient. The sole example is Kondoh and Kurata (2021), who only focus on a developing country. This industry contributes to an increase in employment in the agricultural sector, inducing the production of agricultural goods to be indirectly consumed by tourists. Different from Kondoh and Kurata's (2021) study in which there is no domestic capital owner and no domestic consumption of agritourism, both agritourism and agricultural goods are alternatively consumed by domestic residents, capital owners, and workers. Kondoh and Kurata (2021) consider only environmentally friendly agritourism in which actions such as planting trees or cleaning beaches contribute to the improvement of the natural environment, which directly determines the productivity of agriculture (Copeland and Taylor, 1999). However, in this study, we consider more general cases in which agritourism may or may not be environmentally friendly. Hence, our study highlights the characteristics of the economy of a developed country and, by combining the literature on agritourism and environmental protection, provides new insights into policies in developed countries.

The remainder of this study is organized as follows. In Section 2, we present our model. Section 3 is dedicated to the analysis, and Section 4 presents our concluding remarks.

2. The Model

The basic model of this study is similar to that of Kondoh and Kurata (2021). We extend the basic model of Copeland and Taylor (1999) and assume the existence of a small, developed country with three industries:

- A smokestack manufacturing industry located in an urban area that generates pollution.
- An environmentally sensitive agricultural industry located in a rural area that suffers from pollution.
- An agritourism industry located in a rural area that is either environmentally friendly or environmentally unfriendly.

The primary factors of production are labor, capital, and environmental stock. Capital is a specific factor in the production of manufacturing goods, whereas the level of environmental stock regulates the productivity of agricultural goods. We assume that the agritourism industry manages to supply touristic services combining agricultural goods (e.g., local foods) and labor input (e.g., accommodation services). Additionally, we consider two possible types of agritourism. The first is environmentally friendly tourism, which contributes to environmental protection, as in Kondoh and Kurata (2021). Let us call this type of agritourism "ecological agritourism." The second type is environmentally unfriendly tourism, which is similar to traditional and ordinary tourism that could harm the natural environment. Let us call this type of agritourism "exploitative agritourism."[4]

The production functions of the manufacturing, agricultural, and agritourism industries in this country are defined as follows:

$$M = F(\bar{K} + \tilde{K}, L_M), \tag{1}$$

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

$$S = \beta L_S, \tag{3}$$

where E is environmental stock; M, $\bar{K}$, $\tilde{K}$, and L_M are, respectively, the output, domestic capital input, foreign capital input, and labor input of the manufacturing industry; A and L_A are the output and labor input of the agricultural industry; S and L_S are the output and labor input of the agritourism services; and β is the parameter that reflects the productivity of the agritourism industry.[5] In this study, we consider the case of a capital-abundant developed country that exports capital to the rest of the world. Thus, in this study, the sign of $\tilde{K}$ is negative.

One unit of agritourism is supplied to domestic tourists as a combination of one unit of service and q units of agricultural goods. Thus, the total output of agritourism can be expressed as follows:

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[4] For example, we can imagine a rural tour for people from developed countries with accommodation, local foods, and experiences such as planting fruit trees or voluntary beach cleaning activities.

[5] We assume the ordinary properties of the production function of the manufacturing industry; that is, $F_L > 0, F_K > 0, F_{LL} < 0, F_{KK} < 0, F_{LK} > 0$ and $F_{LL}F_{KK} - F_{LK}^2 > 0$.

$$X = S = \beta L_S = q^{-1} A_T, \tag{4}$$

where X denotes the output of agritourism, and A_T stands for the total amount of agricultural goods supplied to domestic tourists.

The production activity in the manufacturing industry causes pollution, which harms the natural environment. We assume that the level of environmental stock is a decreasing function of the amount of pollution emitted by the manufacturing industry. Moreover, we consider the positive effects on the natural environment caused by agritourism activities. Therefore, the net stock of environmental capital is

$$E = \bar{E} - \lambda_1 M + \lambda_2 X \ , \tag{5}$$

where $\bar{E}$ is the natural stock level of environmental capital before damages and λ_1 and λ_2 are, respectively, parameters that reflect the magnitude of effects on the natural environment caused by one unit of manufacturing and agritourism output. As manufacturing causes pollution, which damages the natural environment, we reasonably assume λ_1 has a positive sign. Conversely, the sign of λ_2 depends on the property of tourism. If the agritourism is ecological (exploitative), expanding agritourism causes positive (negative) effects on the natural environment; thus, $\lambda_2 > 0$ $(\lambda_2 < 0)$, respectively.

The wage rate of the manufacturing industry located in the urban area is w^*, which is endogenously determined by perfect competition and equal to the value of marginal products of labor. We reasonably assume that there exists structural, frictional unemployment in the urban area, which implies that some of the urban workers are not employed during the job-seeking period. Let L_U denote the number of unemployed workers, and η denote the ratio of unemployed to employed workers in the urban area, L_U / L_M. Similar to the Harris–Todaro framework, urban workers can obtain w^* by the manufacturing industry if employed, but they do not receive wages if not employed. The possibility of a worker being employed or not in every period depends only on a random probability. However, as we assume competitive wage rates in the agricultural and agritourism industries, the wage rates w in both sectors are equal. In the equilibrium after domestic labor mobility between the two regions, we have

$$w = w^* \frac{L_M}{L_M + L_U}, \tag{6}$$

and

$$w^* = (1+\eta)w. \tag{7}$$

Regarding the industry structure, as we assume perfect competition with free entry in both the manufacturing and agricultural industries, the total profits in the manufacturing and agricultural industries, π_M and π_A, can be expressed as follows, respectively,

$$\pi_M = \bar{p}_M M - w^* L_M - \bar{r}(\bar{K} + \tilde{K}), \tag{8}$$

$$\pi_A = A - wL_A, \tag{9}$$

where the agricultural good is the numeraire, $\bar{p}_M$ denotes the price of the manufactured good, and $\bar{r}$ denotes the rental price of foreign capital. We assume this small country confronts free trade and free international capital mobility, and thus both $\bar{p}_M$ and $\bar{r}$ are exogenously given. Under the assumption that both goods are produced, profit maximization conditions in the manufacturing and agricultural industries yield

$$\frac{\partial \pi_M}{\partial L_M} = \bar{p}_M F_L(\bar{K} + \tilde{K}, L_M) - (1+\eta)w = 0, \tag{10}$$

$$\frac{\partial \pi_M}{\partial (\bar{K} + \tilde{K})} = \bar{p}_M F_K(\bar{K} + \tilde{K}, L_M) - \bar{r} = 0, \tag{11}$$

$$\frac{\partial \pi_A}{\partial L_A} = \sqrt{E} - w = 0. \tag{12}$$

Condition (12) shows that w depends on the level of net stock of the environment.[6] The full employment condition is

$$L_M + L_A + L_S + L_U = \bar{L} + \tilde{L}, \tag{13}$$

[6] In this model, labor in the service sector receives the competitive wage rate w determined in the agricultural sector because agricultural farms undertake agritourism.

where $\bar{L}$ and $\tilde{L}$ denote the domestic labor endowment and the total amount of immigrants, respectively. We assume that this developed country is capital-abundant; thus, $\tilde{L}$ has a positive sign.

We also assume perfect competition with free entry in the agritourism industry. Thus, the price of one unit of agritourism goods should equal its marginal cost, $p_{AT} \equiv \beta^{-1}w + q$. Here, an agritourism good is assumed to be non-tradable because it needs labor input such as service activities. Therefore, under free trade, this capital-abundant developed country exports manufacturing goods and imports agricultural goods. The trade balance condition is

$$\bar{p}_M[F(\bar{K}+\tilde{K}, L_M) - D_M] = q\beta L_S + D_A - wL_A, \tag{14}$$

where D_M and D_A are the domestic residents' (including immigrants) aggregate consumption levels of manufactured and agricultural goods, respectively.

Unlike in the case of a developing country studied by Kondoh and Kurata (2021), all three goods (i.e., manufacturing, agricultural, and agritourism goods) are consumed by domestic residents. Thus, on the demand side, we specify the following social utility function of domestic residents:

$$U = (D_M)^{\alpha}[(D_A)^{\gamma} S^{1-\gamma}]^{1-\alpha}, \quad 0<\alpha<1, 0<\gamma<1, \tag{15}$$

where α and γ are the parameters that reflect the preferences for manufactured goods and agricultural goods, respectively.[7] As each firm obtains zero profit, the GDP of this country is equal to the capital and labor income, $\bar{r}\bar{K} + w(\bar{L}+\tilde{L})$. Therefore, the demand for each good is obtained by solving the utility maximization problem, subject to the following budget constraint:

$$D_A + \bar{p}_M D_M + (w+\beta q)L_S = w(\bar{L}+\tilde{L}) + \bar{r}\bar{K}. \tag{16}$$

Hence, we have

$$\gamma L_S(w+\beta q) = (1-\gamma)D_A, \tag{17}$$

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[7] Let $\delta \equiv \gamma(1-\alpha)$. Then, we can rewrite (15) as $U = (D_M)^{\alpha}(D_A)^{\delta} S^{1-\alpha-\delta}, 0<\alpha<1, 0<\delta<1.$

$$\alpha D_A = \gamma(1-\alpha)\bar{p}_M D_M . \tag{18}$$

From (5) and (12), we can assert that

$$\bar{E} - \lambda_1 F(\bar{K} + \tilde{K}, L_M) + \lambda_2 \beta L_S = w^2 , \tag{19}$$

and from (13), (14), and (16) to (18), we can obtain the following two conditions:

$$\gamma(1-\gamma)(1-\alpha)[w(\bar{L} + \tilde{L}) + r\bar{K}] - \gamma(w + \beta q)L_S = 0 , \tag{20}$$

$$\bar{p}_M F(\bar{K} + \tilde{K}, L_M) - r\bar{K} - w(1+\eta)L_M = 0 . \tag{21}$$

Thus, we have five equations, (10), (11), and (19) to (21), which determine five endogenous variables. $\tilde{K}, L_M, L_S, w,$ and η are in equilibrium given the exogenous variables $\bar{E}, \bar{L}, \tilde{L}, \alpha, \beta, \gamma, q, \bar{K}, \lambda_1$, and λ_2.

3. Comparative Statics

Totally differentiating (10), (11), (19), (21), and (20), we have

$$\begin{bmatrix} \bar{p}_M F_{LK} & 0 & \bar{p}_M F_{LL} & -(1+\eta) & -w \\ \bar{p}_M F_{KK} & 0 & \bar{p}_M F_{LK} & 0 & 0 \\ -\lambda_1 F_K & \lambda_2 \beta & -\lambda_1 F_L & -2w & 0 \\ \bar{p}_M F_K & 0 & 0 & -(1+\eta)L_M & -wL_M \\ 0 & -\gamma(w+\beta q) & 0 & \Phi & 0 \end{bmatrix} \begin{bmatrix} d\tilde{K} \\ dL_S \\ dL_M \\ dw \\ d\eta \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ -\gamma(1-\gamma)(1-\alpha)w \end{bmatrix} d\tilde{L} + \begin{bmatrix} 0 \\ 0 \\ -\lambda_2 L_S \\ 0 \\ \gamma q L_S \end{bmatrix} d\beta + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ \gamma\beta L_S \end{bmatrix} dq + \begin{bmatrix} 0 \\ 0 \\ F \\ 0 \\ 0 \end{bmatrix} d\lambda_1 + \begin{bmatrix} 0 \\ 0 \\ -\beta L_S \\ 0 \\ 0 \end{bmatrix} d\lambda_2. \tag{22}$$

where $\Phi = \gamma[(1-\gamma)(1-\alpha)(\bar{L}+\tilde{L}) - L_S]$. The determinant of the matrix of (22) is

$$\Delta = \bar{p}_M{}^2 w[L_M(F_{LL}F_{KK} - F_{LK}{}^2) + F_K F_{LK}][\lambda_2 \beta\Phi - 2w\gamma(w+\beta q)] \tag{23}$$

and the sign of Δ is sufficiently negative if agritourism is ecological $(\lambda_2 > 0)$ and the domestic preference for the manufactured good, α, is sufficiently large to satisfy $\Phi < 0$. Thus, in this study, we only consider the case of ecological agritourism.

3.1. Policy Changes in Developed Countries

We now discuss the effects of specific policy changes in developed countries. Developed countries such as Italy and Japan, attempting to enhance domestic economic welfare and reduce the unemployment rate in urban areas, have introduced the following economic policies: 1) A policy aimed at encouraging labor inflow, which may contribute to enhancing the labor supply surplus and 2) a policy to restrict emission of pollution from the manufacturing sector, which may expand productivity in the agricultural industry in rural areas. We examine the effects of these policies using comparative statics.

3.1.1 Labor Inflow

First, let us consider an increase in labor endowment due to emigration. From (22), simple calculations yield

$$\frac{d\tilde{K}}{d\tilde{L}} = 0\,, \tag{24}$$

$$\frac{dw}{d\tilde{L}} = -\frac{1}{\Delta}\beta\lambda_2 w^2 \bar{p}_M{}^2\gamma(1-\gamma)(1-\alpha)[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_{LK}F_K] > 0\,, \tag{25}$$

$$\frac{dL_M}{d\tilde{L}} = 0\,, \tag{26}$$

$$\frac{d\eta}{d\tilde{L}} = \frac{1}{\Delta}\beta\lambda_2 \bar{p}_M{}^2\gamma(1-\gamma)(1-\alpha)w(1+\eta)L_M[(F_{KK}F_{LL} - F_{LK}{}^2) + F_{LK}F_K] < 0 \tag{27}$$

$$\frac{dL_S}{d\tilde{L}} = -\frac{1}{\Delta}2\gamma(1-\gamma)(1-\alpha)w^3 \bar{p}_M{}^2[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_{LK}F_K] > 0, \tag{28}$$

$$\frac{dw^*}{d\tilde{L}} = (1+\eta)\frac{dw}{d\tilde{L}} + w\frac{d\eta}{d\tilde{L}} = 0\,. \tag{29}$$

We can conclude that labor inflow due to migration will reduce the labor and capital input in the manufacturing sector. This result implies that the total output and export of manufactured goods will decrease. However, after immigration, the agriculture sector will expand, and, surprisingly, both urban and rural wage rates will increase. Regarding the effect on the environmental capital stock, we obtain the following relationship from (12):

$$\operatorname{sgn} dw = \operatorname{sgn} dE\,, \tag{30}$$

which implies that immigration will be environmentally friendly for the host country. This is because immigration causes capital outflow and reduces the magnitude of the manufacturing sector, which reduces environmental pollution. However, employment in the agritourism sector increases, and expanding this sector will improve the natural environment. From (30), the higher environmental stock of this developed country implies a higher competitive wage rate in the rural area. Although the effects on the ratio of unemployed to employed workers in the urban area, η, are not clear, the urban wage rate will also increase after immigration.

Next, we consider the effect on welfare. In this model, as the competing firms in the manufacturing industry obtain zero profit, national welfare will be equal to the economic welfare of the workers and capital owners. Note that that the rental price of capital stays constant due to free capital mobility; therefore, the nominal income level of capital owners is unchanged after immigration. Thus, the welfare level depends on the competitive wage rate in the rural area, which is equal to the expected income of a representative worker. Moreover, because of free trade, the price of manufactured goods also remains unchanged after immigration, and indirect welfare only depends on the price of agritourism. The expenditure function is defined as

$$e(p_{AT}, V) = w(\bar{L} + \tilde{L}) + \bar{r}\bar{K}\,, \tag{31}$$

where V denotes the utility level of this country. Totally differentiating (31),

$$\frac{\partial e}{\partial p_{AT}} dp_{AT} + \frac{\partial e}{\partial V} dV = \bar{L}dw + wd\tilde{L}\,. \tag{32}$$

From Shephard's lemma, we have $\partial e / \partial p_{AT} = \beta L_S$, and applying $p_{AT} \equiv \beta^{-1} w + q$, (32) yields

$$dV = (\frac{\partial e}{\partial V})^{-1}[(\bar{L} + \tilde{L} - L_S)dw + wd\tilde{L} + w\beta^{-1}L_S d\beta - \beta L_S dq], \tag{33}$$

$$\frac{dV}{d\tilde{L}} = (\frac{\partial e}{\partial V})^{-1}(\bar{L} + \tilde{L} - L_S)\frac{dw}{d\tilde{L}} + w > 0\,. \tag{34}$$

Considering that the sign of (34) is positive, permitting labor inflow produces a welfare-enhancing effect for the developed country. Thus, we establish the following proposition:

Proposition 1. (1) Labor inflow will not change the labor and capital input into the manufacturing industry but will enhance labor input into the agritourism industry. Competitive wage rates in the rural area will increase while the urban wage rate will remain constant.
(2) Labor inflow will have positive effects on the level of environmental stock and domestic economic welfare.
(3) The urban unemployment rate and the urban–rural wage gap will decrease after immigration.

It should be noted that even though total labor endowment in this developed country increases after immigration, both capital and labor employment in the manufacturing sector remain unchanged in equilibrium. All the additional workers are employed in the agricultural and agritourism sectors. As the total domestic demand for manufactured goods in this country will increase after immigration due to the increased population, total exports of manufactured goods will certainly decrease. Due to the trade balance, this also implies a decrease in total imports of agricultural goods. Domestic production of agricultural goods will increase to compensate for the reduced imports of agricultural goods.

Noting that Kondoh and Kurata (2021) conclude that labor outflow will have positive effects on the economic welfare of the residents in the developing country, we can assert that both the host and source countries will gain from international migration. It will also contribute to global environmental improvement.

3.1.2. Improving the Pollution Abatement Technology in the Manufacturing Industry

Next, let us consider improving the pollution abatement technology in the manufacturing industry through stronger environmental protection policies. From (22), simple calculations yield

$$\frac{d\tilde{K}}{d\lambda_1} = 0, \tag{35}$$

$$\frac{dw}{d\lambda_1} = \frac{1}{\Delta}\bar{p}_M^2 F\gamma w(w+\beta q)[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] < 0, \tag{36}$$

$$\frac{dL_M}{d\lambda_1} = 0, \tag{37}$$

$$\frac{d\eta}{d\lambda_1} = -\frac{1}{\Delta}\bar{p}_M^2 F\gamma(w+\beta q)(1+\eta)[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] > 0, \tag{38}$$

$$\frac{dL_S}{d\lambda_1} = \frac{1}{\Delta}\bar{p}_M^2 wF\Phi[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] > 0, \tag{39}$$

$$\frac{dw^*}{d\lambda_1} = (1+\eta)\frac{dw}{d\lambda_1} + w\frac{d\eta}{d\lambda_1} = 0, \tag{40}$$

$$\frac{dV}{d\lambda_1} = \left(\frac{\partial e}{\partial V}\right)^{-1}(\bar{L} + \tilde{L} - L_S)\frac{dw}{d\lambda_1} < 0. \tag{41}$$

Improving the pollution abatement technology in the manufacturing industry (decreasing λ_1) will enhance the rural competitive wage rate and reduce the ratio of unemployed to employed workers in the urban area. This result implies a reduction in the wage gap between urban and rural workers. Simultaneously, due to the reduction of negative effects on the natural environment through technological improvement, the environmental stock will be improved even though the manufacturing sector is expanded. Finally, from (40), improving the pollution abatement technology in the manufacturing industry will have a positive effect on domestic economic welfare. Hence, we establish the following proposition:

Proposition 2. (1) Improvement of pollution abatement technology in the manufacturing industry will enhance the competitive wage rate in the rural area, the natural environment, and urban

employment while the urban wage rate will remain unchanged. The output of agritourism will decrease.

(2) Improvement of pollution abatement technology in the manufacturing industry will enhance the economic welfare of domestic residents.

As the price of agritourism increases due to shrinking production, the welfare of capital owners, whose nominal income is unchanged, will decrease. However, in total, due to the increased welfare of rural workers, the effects on the aggregate economic welfare of domestic people will be positive.

3.2. Improving the Agritourism Sector

Next, let us discuss the technical improvements in the agritourism sector that may enhance economic welfare, reduce urban unemployment, and increase labor productivity in the tourism sector. As in Kondoh and Kurata (2021), these improvements include: 1) improving labor productivity in the agritourism sector, 2) shifting to agricultural-goods-intensive tourism, and 3) introducing environmentally friendly technology.

3.2.1. Shifting to Agricultural-goods-intensive Tourism

First, let us consider a shift to more agricultural-goods-intensive agritourism. For example, an additional experience such as apple harvesting will enrich other agritourism services such as accommodation with local food. This reform will make it possible to consume more of the agricultural goods in one unit of tourism goods, which translates into an increase in q in our model. From (22), simple calculations yield

$$\frac{d\tilde{K}}{dq}=0, \tag{42}$$

$$\frac{dw}{dq}=\frac{1}{\Delta}\gamma\beta^2\lambda_2 w\bar{p}_M{}^2L_S[L_M(F_{KK}F_{LL}-F_{LK}{}^2)+F_{LK}F_K]<0, \tag{43}$$

$$\frac{dL_M}{dq}=0, \tag{44}$$

$$\frac{d\eta}{dq}=-\frac{1}{\Delta}\gamma\beta^2\lambda_2\bar{p}_M{}^2L_S(1+\eta)L_M[(F_{KK}F_{LL}-F_{LK}{}^2)+F_{LK}F_K]>0, \tag{45}$$

$$\frac{dL_S}{dq}=\frac{1}{\Delta}2w^2\bar{p}_M{}^2\gamma\beta L_S[L_M(F_{KK}F_{LL}-F_{LK}{}^2)+F_{LK}F_K]<0, \tag{46}$$

$$\frac{dw^*}{dq}=(1+\eta)\frac{dw}{dq}+w\frac{d\eta}{dq}=0, \tag{47}$$

$$\frac{dV}{dq} = (\frac{\partial e}{\partial V})^{-1}(\bar{L} + \tilde{L} - L_S)\frac{dw}{dq} - \beta L_S < 0. \tag{48}$$

These results imply that a shift to a more agricultural-goods-intensive agritourism will reduce the labor input of the tourism industry. In the case of ecological agritourism, labor input in the manufacturing industry will increase. The rural competitive wage rate and the level of environmental stock will decrease, and the urban unemployment ratio will increase. Furthermore, the effect on domestic welfare will be negative. Hence, we establish the following proposition:

Proposition 3. (1) Shifting to a more agricultural-goods-intensive agritourism industry will reduce the labor input into the agritourism industry. The competitive wage rate in the rural area and the natural environmental stock will decrease while the unemployment ratio will increase in the case of ecological agritourism.
(2) Shifting to a more agricultural-goods-intensive agritourism industry will have a negative effect on domestic welfare in the case of ecological agritourism.

Therefore, in the case of ecological agritourism, an increase in the per capita consumption of agricultural goods in the agritourism industry might reduce economic welfare, the level of the natural environment, and the urban unemployment ratio. These results come from the direct effect of lowering environmentally friendly agritourism's output. The above results are similar to those of Kondoh and Kurata (2021). However, unlike their study, in which the price of manufactured goods is endogenous, we can obtain negative results for domestic welfare without any assumptions about the production function of the manufacturing industry.

3.2.2. Environmentally Friendly Agritourism

Next, let us consider a situation in which the agritourism industry becomes more environmentally friendly; for example, introducing sustainable activities such as planting trees. Such a reform will enhance the positive effect of agritourism on the natural environment. In our model, this means that λ_2 would increase. From (22), simple calculations yield

$$\frac{d\tilde{K}}{d\lambda_2} = 0, \tag{49}$$

$$\frac{dw}{d\lambda_2} = -\frac{1}{\Delta}\beta L_S \bar{p}_M^2 w\gamma(w + \beta q)[L_M(F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] > 0, \tag{50}$$

$$\frac{dL_M}{d\lambda_2} = 0, \tag{51}$$

$$\frac{d\eta}{d\lambda_2} = \frac{1}{\Delta}\beta L_S \bar{p}_M^2 \gamma (w+\beta q)(1+\eta)[L_M (F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] < 0\,, \tag{52}$$

$$\frac{dL_S}{d\lambda_2} = -\frac{1}{\Delta}\beta L_S \bar{p}_M^2 w\Phi[L_M (F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] < 0, \tag{53}$$

$$\frac{dw^*}{d\lambda_2} = (1+\eta)\frac{dw}{d\lambda_2} + w\frac{d\eta}{d\lambda_2} = 0\,, \tag{54}$$

$$\frac{dV}{d\lambda_2} = (\frac{\partial E}{\partial V})^{-1}(\bar{L} + \tilde{L} - L_S)\frac{dw}{d\lambda_2} > 0\,. \tag{55}$$

Equation (55) implies that shifting to more environmentally friendly agritourism will reduce the labor input of the agricultural industry. The urban and rural wage rates and the level of environmental stock will increase; the urban unemployment ratio will decrease. Furthermore, we can conclude that the effect on domestic welfare could also be positive. Hence, we establish the following proposition:

Proposition 4. (1) Shifting to a more environmentally friendly agritourism will reduce its labor input. The output of manufactured goods, the rural wage rates, and the natural environmental stock will increase, while the urban unemployment ratio and urban–rural wage gap will decrease. (2) Shifting to a more environmentally friendly agritourism will enhance domestic welfare.

Therefore, a more environmentally friendly agritourism will have a positive effect on welfare and the level of the natural environment. In the equilibrium, an increased competitive wage rate will reduce the urban unemployment ratio. Thus, although it looks paradoxical, in our model, labor reallocates from the tourism sector to the agricultural sector, but the wage rate of the agricultural sector will increase due to environmental improvement in the equilibrium.

3.2.3 Increasing the Labor Productivity of Tourism

Finally, let us consider an increase in labor productivity in the agritourism sector, namely, an increase in β. This technological improvement implies that the same amount of tourism goods can now be produced with less labor input than before. From (22), simple calculations yield

$$\frac{d\tilde{K}}{d\beta} = 0\,, \tag{56}$$

$$\frac{dw}{d\beta} = -\frac{1}{\Delta}\gamma\lambda_2 \bar{p}_M^2 w^2 L_S[L_M (F_{KK}F_{LL} - F_{LK}{}^2) + F_K F_{LK}] > 0\,, \tag{57}$$

$$\frac{dL_M}{d\beta} = 0\,, \tag{58}$$

$$\frac{d\eta}{d\beta}=\frac{1}{\Delta}\lambda_2 L_S \bar{p}_M^2 \gamma w(1+\eta)[L_M(F_{KK}F_{LL}-F_{LK}{}^2)+F_K F_{LK}]<0\,, \tag{59}$$

$$\frac{dL_S}{d\beta}=\frac{1}{\Delta}\bar{p}_M{}^2 wL_S(2w\gamma q-\lambda_2\Phi)[L_M(F_{KK}F_{LL}-F_{LK}{}^2)+F_K F_{LK}]<0, \tag{60}$$

$$\frac{dw^*}{d\beta}=(1+\eta)\frac{dw}{d\beta}+w\frac{d\eta}{d\beta}=0\,, \tag{61}$$

$$\frac{dV}{d\beta}=(\frac{\partial e}{\partial V})^{-1}(\bar{L}+\tilde{L}-L_S)\frac{dw}{d\beta}+\frac{w}{\beta}L_S>0\,. \tag{62}$$

Equation (60) implies that technological improvement in labor productivity in the tourism sector will reduce the labor input of the tourism sector in the equilibrium. In the case of ecological agritourism, the output of manufactured goods will decrease. The output of agriculture will increase. Moreover, an increase in labor productivity in tourism will enhance the rural wage rate and reduce the urban unemployment rate and urban–rural wage gap. Economic welfare will definitely increase. Hence, we establish the following proposition:

Proposition 5. (1) In the case of ecological agritourism, an increase in labor productivity in tourism will reduce the labor input in both the manufacturing and tourism sectors and enhance that in the agricultural sector.

(2) An increase in labor productivity in tourism will enhance the rural wage rate and reduce the unemployment rate in the urban area and the urban–rural wage gap.

(3) An increase in labor productivity in tourism will enhance the stock of the natural environment and economic welfare.

The above proposition asserts that in the case of ecological agritourism, a technological improvement that saves labor input in the agritourism sector will have a positive effect on the developed country. These results are similar to those of Kondoh and Kurata (2021), whose conclusions also suggested welfare-improving results.

4. Concluding Remarks

We have considered how policies in a developed country and improvements in the agritourism sector may affect the economy. Introducing more advanced pollution abatement technology into the manufacturing sector or introducing more environmentally friendly activities into agritourism will be beneficial to the domestic economy in terms of increasing welfare and rural wage rates, and decreasing the wage gap between workers. Similar positive results will occur

if tourism can shift to service-intensive production or increase labor productivity. We demonstrated that encouraging labor inflow is also reasonable for a developed country since it has a positive effect on domestic welfare and reduce the unemployment rate and urban–rural wage gap.

It should be noted that the above positive effects are only valid when agritourism is ecological. If agritourism is exploitative, the negative sign of Δ is not guaranteed. However, following Kondoh and Kurata (2021), who conclude that labor outflow is beneficial to a developing country, we believe that there is the possibility of a win-win situation between the source and host countries of international migration.[8]

Several aspects still need to be considered. First, our study only focused on the supply side of agritourism in a developed economy. Future studies should analyze the demand side of the agritourism sector in greater detail. Second, it might be meaningful to study the necessary conditions of the above-mentioned win-win situation as applied a two-country general equilibrium model. Third, it might be interesting to study exogenous changes in domestic preferences. People may prefer manufactured goods less than before due to expanding agritourism.

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[8] Some counter-intuitive results, including that immigration enhances domestic wage rates, come from (2), originally introduced by Copeland and Taylor (1999). This assumes that no capital input in the agriculture sector is still controversial because, in reality, at least in developed countries, agricultural production needs huge capital investment.

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