

Agritourism, Unemployment, and Economic Welfare in a Developed Country

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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. This country consists of 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 two areas and the structural, frictional unemployment in the urban area. We demonstrate that encouraging labor inflow improves the natural environment and domestic welfare. We also assert that an enhancement of the ratio of agricultural goods to touristic services in the agritourism sector will improve the level of the natural environment, domestic welfare, and the urban unemployment rate. Environmentally friendly agritourism also will cause positive effects on the environment, welfare, and employment. On the other hand, we conclude that agricultural-good-intensive tourism will cause negative effects.

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 implies an agricultural environment which attracts visitors for agricultural operations, recreation, entertainment, and/or educational experiences.¹ As it is widely mentioned and accepted, agritourism is considered beneficial to producers and communities. Farmers take advantage of the opportunities available to generate additional income and obtain a direct marketing channel to consumers, while the tourism industry benefits from the increase in the number of visitors and in their length of stay. Unlike ordinary tourism which sometimes harms the natural environment, agritourism might be possible to be environmentally friendly with visitors' planting, harvesting, and feeding experiences. Moreover, the agritourism business may contribute to expanding job opportunities in rural area, and enhanced national income will improve domestic welfare.

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

First, in developing countries, the agritourism sector mainly targets to foreign visitors from rich countries. Services of this sector are not supposed to be consumed by 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 While in the developed countries, agritourism is focused primarily on domestic tourists. This implies that the

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, hay rides, cut-your-own Christmas tree farms, dude ranches, demonstration farms, agricultural museums, living history farms, on-farm farmers' markets, winery tours and wine tasting, rural bed and breakfasts, and garden tours are conducted in the United States.

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

total output of agritourism directly reflects the welfare of domestic residents who consumes the services in this sector.

Second, as the 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 admit such international labor outflow in most cases. Also, in developing countries, as Harris and Todaro (1970) formalized, there exist urban-rural migration and urban unemployment caused by fixed high wage rate in the urban area. Additionally, domestic capital in developing countries is quite scarce. Thus, governments in developing countries often earnest to introduce foreign direct investment (FDI). We need to remark that in some LDCs, almost all of the capital is owned by foreign investors, and thus capital income does not consist national income of the developing country. On the other hand, in this study, we focus on the economy of the developed countries with agritourism sectors. As the capital/labor ratio is relatively high, the developed country exports capital under free capital mobility. All of the capital income of the manufacturing sector in the developed countries will belong to the national income of this country. Labor market is also different. It is natural and realistic to consider that urban wage rate is flexible, but structural frictional unemployment exists in urban area which causes wage gap between two areas. In the rural area, similar to developing countries, we reasonably can assume full employment.

The purpose of this study is to examine the effects of different policies in a developed country with an agritourism sector compared with the cases in a developing country which have already been studied by Kondoh and Kurata (2021). We investigate the effects of an exogenous change in 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-good-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 of every sector, while 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

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

agricultural goods depends on the stock level of environmental capital, which will be damaged by the manufacturing sector but saved by agritourism. As our study focuses on the economy of a developed country, different from Kondoh and Kurata (2021), we assume 1) domestic capital owners, 2) free capital mobility, 3) free trade, 4) domestic consumption of all three goods, that is, manufacturing, agricultural and agritourism.

The main results of our study are as follows. First, we demonstrate that encouraging labor inflow improves the natural environment and domestic welfare. Second, we also can assert that an enhancement of the ratio of agricultural goods to touristic services in the agritourism sector will improve the level of the natural environment, domestic welfare, and the urban unemployment rate. Environmentally friendly agritourism also will cause positive effects on the environment, welfare, and employment. On the other hand, we conclude that agricultural-good-intensive tourism will cause negative effects.

On several points, the above conclusions differ from those of Kondoh and Kurata (2021), which studied the case of a developing country. Different from our intuitions, this study shows that labor inflow has positive effects on the wage rate of workers in both urban and rural areas. This is because immigration causes capital outflow and reduces the magnitude of the manufacturing sector, which yields a reduction in pollution. On the other hand, employment in the agritourism sector increases, and expanding this sector will improve the natural environment. These effects lead to the improvement of the natural environment, and the wage rate of the rural area is just equal to the productivity of the agricultural sector. The effects caused by the improvement of the agritourism sector are similar to those of Kondoh and Kurata (2021), but both the urban wage rate and unemployment rate are endogenously determined in this study.

Before proceeding, we discuss the relation of this study with existing research. We can categorize studies about agritourism into three major groups. The first group, which includes Galuzzo (2018) and McGehee and Kim (2004), define the properties of agritourism by focusing on the incentives of the supply side of starting a business. The second group, including Carpio et al. (2008), Santeramo and Barbieri (2017), and Sidali et al. (2019), investigate the incentives of the demand side such as tourists' preferences and properties. Finally, the third group of studies, which include Jeczmiak et al. (2015), Maude and van Rest (1985), Schilling et al. (2012), and Kondoh and Kurata (2021) on the economic effects of agritourism, 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 U.S., the U.K., and Italy, while only a few theoretical studies have been carried out.

Considering 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), used a trade model to investigate the agritourism industry. Furukawa et al. (2019) focused on a rural area of a developed country and studied the effects of the inflow of capital, labor, and tourists from outside the area, while Yabuuchi (2013, 2015) studied the economic effects of tourism promotion in developing countries by applying an extended urban-rural migration model by Harris and Todaro (1970). The studies above 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 that focus on the effects of economic policies under the existence of the agritourism sector are not accumulated enough. The only exception is Kondoh and Kurata (2021), which just studied the case of a developing country. This industry contributes to the increase in employment in the agricultural sector, inducing part of the agricultural goods produced to be indirectly consumed by tourists. Different from Kondoh and Kurata (2021) in which there is no domestic capital owner and no domestic consumption of agritourism, both agritourism and agricultural good are alternatively consumed by domestic residents, capital owners, and workers. Considering that agritourism may foster environmentally friendly actions such as planting trees or cleaning beaches, this sector contributes to the improvement of the natural environment, which directly determines the productivity of agriculture (Copeland and Taylor, 1999). 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 analysis, while section 4 presents our concluding remarks.

2. The Model

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

- The smokestack manufacturing industry, located in an urban area and generates pollution.
- The environmentally sensitive agricultural industry, located in a rural area and suffers from pollution.

- The agritourism industry, which is environmentally friendly and also located in a rural area.

The primary factors of production are labor, capital, and environmental stock. Capital is the specific factor in the production of manufacturing goods, while the level of the environmental stock regulates the productivity of the agricultural good. 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, as opposed to traditional tourism, which could harm the natural environment, agritourism contributes to environmental protection.⁴

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

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

$$A = \sqrt{E}L_A, \quad (2)$$

$$S = \beta L_S, \quad (3)$$

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 which export 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 unit of agricultural goods. Thus, the total output of agritourism can be expressed as follows:

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

⁴ For example, we can imagine a rural tour for the 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,

$$F_L > 0, F_K > 0, F_{LL} < 0, F_{KK} < 0, F_{LK} > 0 \quad \text{and} \quad F_{LL}F_{KK} - F_{LK}^2 > 0.$$

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 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

$$E = \bar{E} - \lambda_1 M + \lambda_2 X, \quad (5)$$

where \bar{E} is the natural stock level of environmental capital before damages; 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.

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 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 wage if not employed. The possibility of a worker being employed or not in every period depends only on a random probability. On the other hand, as we assume competitive wage rates in the agricultural and agritourism industry, the wage rates w in both sectors are equal. In the equilibrium after domestic labor mobility between the two regions, we have

$$w = w^* \frac{L_M}{L_M + L_U}, \quad (6)$$

and

$$w^* = (1 + \eta)w. \quad (7)$$

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

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

$$\pi_A = A - w L_A, \quad (9)$$

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

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

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

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

Condition (12) shows that w depends on the level of net stock of the environment.⁶ The full

employment condition is

$$L_M + L_A + L_S + L_U = \bar{L} + \tilde{L}, \quad (13)$$

where \bar{L} and \tilde{L} denote the domestic labor endowment and the total amount of immigrants,

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.

respectively. We assume that this developed country is capital abundant, and thus \tilde{L} is positive in 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 agritourism good is assumed non-tradable because it needs labor input like service activities. Therefore, under free trade, this capital abundant developed country exports manufacturing goods and imports agricultural goods. The trade balance condition is,

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

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

Remembering that different from the case of a developing country studied by Kondoh and Kurata (2021), all three goods, manufacturing, agriculture, and agritourism goods are consumed by domestic residents. Thus, on the demand side, we specify the following social utility function of domestic residents

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

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

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

Hence, we have

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

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

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

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

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

And from (13), (14), (16) – (18), we can obtain the following two conditions,

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

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

Thus, we have five equations, (10), (11), (19) – (21), which determine five endogenous variables. $\tilde{K}, L_M, L_S, w,$ and η 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

$$\begin{aligned}
& \begin{bmatrix} \bar{p}_M F_{LK} & 0 & \bar{p}_M F_{LL} & -(1+\eta) & -w \\ \bar{p}_M F_{KK} & 0 & \bar{p}_M F_{LK} & 0 & 0 \\ -\lambda_1 F_K & \lambda_2 \beta & -\lambda_1 F_L & -2w & 0 \\ \bar{p}_M F_K & 0 & 0 & \tilde{L} - (1+\eta)L_M & -wL_M \\ 0 & -\gamma(w + \beta q) & 0 & \Phi & 0 \end{bmatrix} \begin{bmatrix} d\tilde{K} \\ dL_S \\ dL_M \\ dw \\ d\eta \end{bmatrix} \\
& = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -w \\ 0 \end{bmatrix} d\tilde{L} + \begin{bmatrix} 0 \\ 0 \\ -\lambda_2 L_S \\ 0 \\ \gamma q L_S \end{bmatrix} d\beta + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ \gamma \beta L_S \end{bmatrix} dq + \begin{bmatrix} 0 \\ 0 \\ F \\ 0 \\ 0 \end{bmatrix} d\lambda_1 + \begin{bmatrix} 0 \\ 0 \\ -\beta L_S \\ 0 \\ 0 \end{bmatrix} d\lambda_2.
\end{aligned} \tag{22}$$

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

$$\begin{aligned}
\Delta = & \bar{p}_M^2 w [L_M (F_{LL} F_{KK} - F_{LK}^2) + F_K F_{LK}] [\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)] \\
& - \bar{p}_M (F_{KK} F_L - F_{LK} F_K) \lambda_1 \gamma (w + \beta q) w \tilde{L}
\end{aligned} \tag{23}$$

and the sign of Δ is negative if the number of initial foreign workers, \tilde{L} is sufficiently small, and domestic preference for the manufactured good, α , is sufficiently large to satisfy $\Phi < 0$.

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, which intend to enhance domestic economic welfare and reduce the unemployment rate in urban areas, introduces the following economic policies: 1) A policy aimed at encouraging labor inflow, which may contribute to enhancing the labor supply surplus; 2) A restriction policy to emit pollution from the manufacturing sector, which may expand productivity in 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

$$\frac{d\tilde{K}}{d\tilde{L}} = -\frac{1}{\Delta} \bar{p}_M w^2 F_{LK} [\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)] < 0, \quad (24)$$

$$\frac{dw}{d\tilde{L}} = -\frac{1}{\Delta} w^2 \gamma(w + \beta q) \lambda_1 \bar{p}_M (F_{LK} F_K - F_{KK} F_L) > 0, \quad (25)$$

$$\frac{dL_M}{d\tilde{L}} = \frac{1}{\Delta} \bar{p}_M w^2 F_{KK} [\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)] < 0, \quad (26)$$

$$\begin{aligned} \frac{d\eta}{d\tilde{L}} = & \frac{1}{\Delta} \{w \bar{p}_M^2 [\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)] (F_{LL} F_{KK} - F_{LK}^2) \\ & + w\gamma(1 + \eta) \lambda \bar{p}_M (w + \beta q) (F_{LK} F_K - F_{KK} F_L)\}, \end{aligned} \quad (27)$$

$$\frac{dL_S}{d\tilde{L}} = \frac{1}{\Delta} p_M \lambda_1 w^2 \Phi (F_{KK} F_L - F_{LK} F_K) < 0, \quad (28)$$

$$\begin{aligned} \frac{dw^*}{d\tilde{L}} = & (1 + \eta) \frac{dw}{d\tilde{L}} + w \frac{d\eta}{d\tilde{L}} \\ = & \frac{1}{\Delta} w^2 \bar{p}_M^2 [\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)] (F_{LL} F_{KK} - F_{LK}^2) > 0, \end{aligned} \quad (29)$$

$$\begin{aligned} \frac{d(w^* - w)}{d\tilde{L}} = & \eta \frac{dw}{d\tilde{L}} + w \frac{d\eta}{d\tilde{L}} \\ = & \frac{1}{\Delta} [w^2 \bar{p}_M^2 \{\lambda_2 \beta \Phi - 2w\gamma(w + \beta q)\} (F_{LL} F_{KK} - F_{LK}^2) \\ & + w^2 \gamma \lambda \bar{p}_M (w + \beta q) (F_{LK} F_K - F_{KK} F_L)]. \end{aligned} \quad (30)$$

We can conclude that labor inflow due to migration will reduce the labor and capital input in the manufacturing sector. This result implies total output and export of manufactured goods will decrease. On the other hand, after immigration, the agritourism sector expands, 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),

$$\text{sgn } dw = \text{sgn } dE. \quad (31)$$

which implies that immigration will be environmentally friendly to the host country. This is because immigration causes capital outflow and reduces the magnitude of the manufacturing sector, which reduces environmental pollution. On the other hand, 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, 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. Remembering that the rental price of capital keeps constant due to free capital mobility, the nominal income level of capital owners is unchanged after immigration. Thus, 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 just depends on the price of agritourism. The expenditure function is defined as

$$e(p_{AT}, V) = w\bar{L} + r\bar{K}, \quad (32)$$

where V denotes the utility level of this country. Totally differentiating (32),

$$\frac{\partial e}{\partial p_{AT}} dp_{AT} + \frac{\partial e}{\partial V} dV = \bar{L}dw. \quad (33)$$

From Shephard's lemma, we have $\partial e / \partial p_{AT} = \beta L_S$, and applying $p_{AT} \equiv \beta^{-1}w + q$, (33) yields

$$\frac{dV}{d\tilde{L}} = \left(\frac{\partial e}{\partial V}\right)^{-1}(\bar{L} - L_S) \frac{dw}{d\tilde{L}} > 0. \quad (34)$$

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 reduce the labor and capital input to the manufacturing industry and labor input to the agritourism industry. Both competitive wage rates in the urban and rural areas will increase.

(2) Domestic agricultural production will increase, and the magnitude of international trade will decrease.

(3) Labor inflow will cause positive effects on the level of environmental stock and domestic economic welfare.

(4) The effects on the urban unemployment rate and the urban-rural wage gap are ambiguous

Remembering that the conclusions by Kondoh and Kurata (2021) suggest that labor outflow will cause 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 global environmental improvement.

3.1.2. Improve the Pollution Abatement Technology in Manufacturing Industry

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

$$\frac{d\tilde{K}}{d\lambda_1} = -\frac{1}{\Delta} F\gamma(w + \beta q)\bar{p}_M F_{LK} w \tilde{L} < 0, \quad (35)$$

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

$$\frac{dL_M}{d\lambda_1} = \frac{1}{\Delta} F\gamma(w + \beta q)\bar{p}_M F_{KK} w \tilde{L} < 0, \quad (37)$$

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

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

$$\frac{dw^*}{d\lambda_1} = (1 + \eta) \frac{dw}{d\lambda_1} + w \frac{d\eta}{d\lambda_1} = \frac{1}{\Delta} \bar{p}_M^2 \gamma F w(w + \beta q) \tilde{L}(F_{KK}F_{LL} - F_{LK}^2) < 0 \quad (40)$$

$$\frac{d(w^* - w)}{d\lambda_1} = \eta \frac{dw}{d\lambda_1} + w \frac{d\eta}{d\lambda_1} \quad (41)$$

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

$$\frac{dV}{d\lambda_1} = \left(\frac{\partial e}{\partial V}\right)^{-1} (\bar{L} - L_S) \frac{dw}{d\lambda_1} < 0. \quad (42)$$

The improving pollution abatement technology in the manufacturing industry (decreasing λ_1) will enhance 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. In addition, the output of manufactured goods will increase. At the same time, due to the reduction of negative effects on the natural environment by technological improvement, the

environmental stock will be improved even though the manufacturing sector is expanded. Finally, from (42), improving pollution abatement technology in the manufacturing industry will have positive effects on domestic economic welfare.

Proposition 2. (1) Improvement of pollution abatement technology in the manufacturing industry will enhance competitive wage rates in the urban and rural areas, the natural environment, and the employment of urban area while it will reduce the urban-rural wage gap. 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 the shrinking of production, the welfare of capital owners whose nominal income is unchanged will decrease. But in total, due to the increased welfare of rural workers, the effects on the aggregate economic welfare of domestic people are positive in sign.

3.2. Improvement of 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. Similar to Kondoh and Kurata (2021), these improvements include: 1) Improvement in labor productivity in the agritourism sector, 2) Shift to agricultural-good-intensive tourism, and 3) Introduction of environmentally friendly technology.

3.2.1. Shift to Agricultural-good-intensive Tourism

First, let us consider a shift to more agricultural-good-intensive agritourism. For example, an additional experience like 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 good in one unit of tourism goods and it translates into an increase in q in our model. From (22), simple calculations yield

$$\frac{d\tilde{K}}{dq} = -\frac{1}{\Delta} \lambda_2 \gamma \beta^2 L_S \bar{p}_M F_{LK} w \tilde{L} > 0, \quad (43)$$

$$\frac{dw}{dq} = \frac{1}{\Delta} \gamma \beta^2 \lambda_2 w \bar{p}_M^2 L_S [L_M (F_{KK} F_{LL} - F_{LK}^2) + F_{LK} F_K] < 0, \quad (44)$$

$$\frac{dL_M}{dq} = \frac{1}{\Delta} \lambda_2 \gamma \beta^2 L_S \bar{p}_M F_{KK} w \tilde{L} > 0, \quad (45)$$

$$\frac{d\eta}{dq} = -\frac{1}{\Delta} \gamma \beta^2 \lambda_2 \bar{p}_M^2 L_S \{ -[\tilde{L} - (1+\eta)L_M](F_{KK}F_{LL} - F_{LK}^2) + (1+\eta)F_{LK}F_K \} > 0 \quad (46)$$

$$\begin{aligned} \frac{dL_S}{dq} &= \frac{1}{\Delta} \{ 2w^2 \bar{p}_M^2 \gamma \beta L_S [L_M(F_{KK}F_{LL} - F_{LK}^2) + F_{LK}F_K] \\ &\quad + \lambda_1 \gamma \beta L_S \bar{p}_M (F_{KK}F_L - F_{LK}F_K) w \tilde{L} \} < 0, \end{aligned} \quad (47)$$

$$\frac{dw^*}{dq} = (1+\eta) \frac{dw}{dq} + w \frac{d\eta}{dq} = \frac{1}{\Delta} \gamma \beta^2 \lambda_2 \bar{p}_M^2 L_S w \tilde{L} (F_{KK}F_{LL} - F_{LK}^2) < 0 \quad (48)$$

$$\frac{d(w^* - w)}{dq} = \eta \frac{dw}{dq} + w \frac{d\eta}{dq} = -\frac{1}{\Delta} \gamma \beta^2 \lambda_2 \bar{p}_M^2 L_S w [(L_M - \tilde{L})(F_{KK}F_{LL} - F_{LK}^2) + F_{LK}F_K] > 0 \quad (49)$$

$$\frac{dV}{dq} = \left(\frac{\partial e}{\partial V} \right)^{-1} (\bar{L} - L_S) \frac{dw}{dq} - 1 < 0. \quad (50)$$

These results imply that a shift to a more agricultural-good-intensive agritourism will reduce the labor input of the tourism industry while that of the manufacturing industry will increase. The competitive wage rate and the level of the 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 good-intensive agritourism industry will reduce the labor input to the agritourism industry. Both the competitive wage rate in urban and rural areas and the natural environmental stock will decrease while the unemployment ratio will increase. (2) Shifting to a more agricultural good-intensive agritourism industry will have a negative effect on domestic welfare.

Therefore, an increase in per capita consumption of agricultural goods in the agritourism industry might reduce the 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 output. The above results are similar to Kondoh and Kurata (2021). However, different from Kondoh and Kurata (2021), in which the price of manufactured goods is endogenous, we can obtain negative results on domestic welfare without any assumptions about the production function of the manufacturing industry.

3.2.2. Environmentally Friendly Agritourism

Next, let us consider the 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, it means that λ_2 would increase. From (22), simple calculations yield

$$\frac{d\tilde{K}}{d\lambda_2} = \frac{1}{\Delta} \beta L_S \gamma (w + \beta q) \bar{p}_M F_{LK} w \tilde{L} < 0, \quad (51)$$

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

$$\frac{dL_M}{d\lambda_2} = -\frac{1}{\Delta} \beta L_S \gamma (w + \beta q) \bar{p}_M F_{KK} w \tilde{L} < 0, \quad (53)$$

$$\frac{d\eta}{d\lambda_2} = \frac{1}{\Delta} \beta L_S \bar{p}_M^2 \gamma (w + \beta q) \{-[\tilde{L} - (1 + \eta)L_M](F_{KK} F_{LL} - F_{LK}^2) + (1 + \eta)F_K F_{LK}\} < 0 \quad (54)$$

$$\frac{dL_S}{d\lambda_2} = -\frac{1}{\Delta} \beta L_S \bar{p}_M^2 w \Phi [L_M (F_{KK} F_{LL} - F_{LK}^2) + F_K F_{LK}] < 0, \quad (55)$$

$$\frac{dw^*}{d\lambda_2} = (1 + \eta) \frac{dw}{d\lambda_2} + w \frac{d\eta}{d\lambda_2} = -\frac{1}{\Delta} \beta L_S \bar{p}_M^2 \gamma w (w + \beta q) \tilde{L} (F_{KK} F_{LL} - F_{LK}^2) > 0 \quad (56)$$

$$\begin{aligned} \frac{d(w^* - w)}{d\lambda_2} &= \eta \frac{dw}{d\lambda_2} + w \frac{d\eta}{d\lambda_2} \\ &= \frac{1}{\Delta} \beta L_S \bar{p}_M^2 \gamma w (w + \beta q) [(L_M - \tilde{L})(F_{KK} F_{LL} - F_{LK}^2) + F_K F_{LK}] < 0 \end{aligned} \quad (57)$$

$$\frac{dV}{d\lambda_2} = \left(\frac{\partial E}{\partial V}\right)^{-1} (\bar{L} - L_S) \frac{dw}{d\lambda_2} > 0. \quad (58)$$

Equation (58) implies that shifting to a 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, while the urban unemployment ratio will decrease. Furthermore, we can conclude 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, both the urban and 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 causes positive effects on welfare and the level of the natural environment. In 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 equilibrium.

3.2.3 Increase in Labor Productivity of Tourism

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

$$\frac{d\tilde{K}}{d\beta} = \frac{1}{\Delta} \lambda_2 L_S \gamma \bar{p}_M F_{LK} w^2 \tilde{L} < 0, \quad (59)$$

$$\frac{dw}{d\beta} = -\frac{1}{\Delta} \gamma \lambda_2 \bar{p}_M^2 w^2 L_S [L_M (F_{KK} F_{LL} - F_{LK}^2) + F_K F_{LK}] > 0, \quad (60)$$

$$\frac{dL_M}{d\beta} = -\frac{1}{\Delta} \lambda_2 L_S \gamma \bar{p}_M F_{KK} w^2 \tilde{L} < 0, \quad (61)$$

$$\frac{d\eta}{d\beta} = \frac{1}{\Delta} \lambda_2 L_S \bar{p}_M^2 \gamma w \{ -[\tilde{L} - (1 + \eta) L_M] (F_{KK} F_{LL} - F_{LK}^2) + (1 + \eta) F_K F_{LK} \} < 0 \quad (62)$$

$$\begin{aligned} \frac{dL_S}{d\beta} = \frac{1}{\Delta} \{ \bar{p}_M^2 w L_S (2w\gamma q - \lambda_2 \Phi) [L_M (F_{KK} F_{LL} - F_{LK}^2) + F_K F_{LK}] \\ + \lambda_1 \gamma q L_S \bar{p}_M (F_{KK} F_L - F_{LK} F_K) w \tilde{L} \} < 0, \end{aligned} \quad (63)$$

$$\frac{dw^*}{d\beta} = (1 + \eta) \frac{dw}{d\beta} + w \frac{d\eta}{d\beta} = -\frac{1}{\Delta} \gamma \lambda_2 w \bar{p}_M^2 L_S \tilde{L} (F_{KK} F_{LL} - F_{LK}^2) > 0 \quad (64)$$

$$\frac{d(w^* - w)}{d\beta} = \eta \frac{dw}{d\beta} + w \frac{d\eta}{d\beta} = \frac{1}{\Delta} \gamma \lambda_2 w^2 \bar{p}_M^2 L_S [(L_M - \tilde{L}) (F_{KK} F_{LL} - F_{LK}^2) + F_K F_{LK}] < 0 \quad (65)$$

$$\frac{dV}{d\beta} = \left(\frac{\partial e}{\partial V} \right)^{-1} (\bar{L} - L_S) \frac{dw}{d\beta} + \frac{w}{\beta^2} > 0. \quad (66)$$

Equation (63) implies that a technological improvement in labor productivity of the tourism sector will reduce the labor input of the tourism sector in equilibrium. Therefore, in total, the output of manufactured goods will decrease. Moreover, the urban and rural wage rates will increase, and the urban unemployment rate will decrease. Hence, we establish the following proposition.

Proposition 5. (1) An increase in the labor productivity of tourism will reduce the labor input in both the manufacturing and tourism sector and enhance that in the agricultural sector.

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

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

The above proposition asserts that a technological improvement that allows saving labor input in the agritourism sector causes positive effects on the developed country. Those results are similar to Kondoh and Kurata (2021), whose conclusions also suggest 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 both the urban and rural wage rates while decreasing the wage gap between workers. Similar happy results will occur if tourism can shift to service-intensive production or increase in labor productivity.

We demonstrated that encouraging labor inflow is also reasonable for a developed country since it has a positive effect on domestic welfare. But this policy is not best one because it may enhance urban unemployment rate and/or urban-rural wage gap. However, following Kondoh and Kurata (2021) which concludes that labor outflow is beneficial for a developing country, we may conclude the possibility of win-win results between the source and host countries of international migration.

There are still aspects that need to be considered since our study only focuses on the supply side of agritourism in a developed economy. In future studies, we should analyze the demand-side of the agritourism sector in greater detail.

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