The Patriot Effect and National Branding of Regional Agricultural Goods

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1. Introduction

This paper proposes a spatial economic model to show how national governments adopt various policies to brand regional agricultural goods by the effective use of the patriot effect.

The patriot effect refers to the fact that many residents are willing to pay extra for local goods in their home country. In trade theory, this is known as home-biased expenditure (Olper and Raimondi, 2008). For example, Wagyu beef, or aroma beef, is very popular around the world. Since 2013, when Japan's Washoku, or Japanese cuisine, was added to the UNESCO Intangible Heritage of Humanity list, people increasingly began to enjoy Sukiyaki and Syabu-syabu in Japanese-style restaurants. Even though the Wagyu method of beef production originated in Japan, such beef is now produced in many countries. In fact, Australian and U.S. Wagyu beef, together with Wagyu-like beef from other countries, has a large global market share. Despite its high price, the Japanese show a strong preference for original Japanese Wagyu beef, such as Kobe beef from Hyogo Prefecture, Matsuzaka beef from Mie Prefecture, and Yonezawa beef from Yamagata Prefecture. These top three Japanese beef brands have a long historical and cultural background, which people appreciate. In addition to Wagyu beef, Japan has its own rice brands, such as Koshihikari rice from Nigata Prefecture and the new Tsuyahime rice from Yamagata Prefecture. Some local governments try to create new regional rice brands, extolling the quality and describing the regional nature, history, and culture of their traditional beef or rice. People in other countries also show an affinity for domestic products, such as European countries' cheese, French wine, Ceylonese tea, Florida oranges of the U.S., Caribbean rum, and so on. The history and culture of each country relates to its traditional foods. A bias in favor of domestic agricultural products can often be observed.

Even though Japan is an industrialized country, its government has protected domestic agricultural markets for Japanese farmers, giving them sustainable and inclusive business strategies through rural development just as other countries' governments have for their farmers. The national government has reformed numerous problems in the agricultural industry and promoted free trade with many countries. In an increasingly competitive domestic market that is increasingly becoming globalized, local farmers have to improve the quality of their traditional brands and also try to create better national brands to keep their market advantages. Bearing the patriot effect

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in mind, the national government encourages local governments to emphasize the natural, historical, and cultural values of their regions.

This paper establishes a simplified spatial economic model to analyze the patriot effect for agricultural goods. In the literature, domestic and imported agricultural goods are differentiated by Armington (1969) and Krugman (1980). Home-biased expenditures on manufactured goods are explored by Brulhart and Trionfetti (2009), and Erikson (2011) explains the patriot effect for agricultural goods in a small, open economy with a Ricardian production structure. None of these sources, though, discuss Armington's (1969) variable preferences between countries and optimal national branding. Substantial research can be found regarding stated preference models for various agricultural goods (Alfnes and Rickerrsen, 2003; Alfnes, 2004).

In the framework of Armington's model (1969), our small, open economic model between one country and the rest of the world expresses people's preferences between domestic and foreign agricultural goods. Preferences in this model are reinterpreted as "endogenous" national branding indexes (NBX) of agricultural goods, which are related to the natural, historical, and cultural resources of each nation.

2. The Model and Economic Equilibrium

In this general equilibrium model of a small, open economy, a trade pattern between one home country and the rest of the world is described as maximizing a nation's social welfare, using the patriot effect related to natural, historical, and cultural resources. Preferences for agricultural goods between home and foreign countries are decided endogenously.

2.1. Assumptions

This spatial economic model of national branding is based on these assumptions:

1) A small, open economic model between one home country and the rest of the world expresses individual behaviors of consumers, agricultural and composite goods sectors, and national governments.
2) Consumers are categorized by the following: eating interests, preference for domestic brands, and the variety between domestic and international food.
3) The representative consumer in all households consumes both domestic and imported agricultural goods, as well as composite goods, subject to disposable income constraints.
4) People appreciate domestic resources such as the wealth of nature, history and culture, and art of their home country. The consumer is willing to pay extra for domestic agricultural goods, depending upon the strength of the patriot effect.
5) The agricultural and composite goods sectors are located in rural and urban areas. Rural industries supply agricultural goods to domestic consumers, and urban industries supply composite goods to domestic and foreign consumers.
6) The government prefers domestic brands of agricultural goods, which benefit rural areas and maximize the social welfare of all households.
7) Households supply the same quality of labor services to the agricultural and composite goods sectors and governmental offices. The only factor of production is

labor.

8) Households earn income from the agricultural and composite goods sectors and from the national government. They pay a lump-sum tax to the national government.
9) Market prices of domestic and imported agricultural goods and composite goods are based on international market prices.
10) Trade is balanced by importing agricultural goods and exporting composite goods. Trade costs, including international transport costs and import and export taxes, are ignored.
11) Domestic transport costs can be ignored.
12) The labor productivity of agricultural goods has traditionally been lower than that of composite goods. Artificial Intelligence (AI) and the Internet of Things (IoT) increase the labor productivity of agricultural goods.

2.2. Households

Household behavior is described as a utility maximization problem for a representative consumer, who prefers to consume more domestic foods but enjoys the variety between domestic and imported foods.

(1) Maximization of a Representative Consumer's Utility

People generally recognize their preference for consuming more domestic agricultural products, depending on the strength of the patriot effect in their country. The representative consumer maximizes utility u by consuming domestic and imported agricultural goods, c_{A_D} and c_{A_I}, respectively, and composite goods, c_Z, constrained by disposable income, $w \equiv y - t_y$. This disposable income is available for an individual after the payment of a lump-sum tax t_y from income, y, where the asymmetric CES utility function of aggregated agricultural goods, $c_A(c_{A_D}, c_{A_I})$, is characterized by two important consumer factors: 1) the patriot effect, which encourages more consumption of domestic agricultural goods β, and 2) the variety of agricultural goods between countries $\rho \left(= \frac{\sigma-1}{\sigma}\right)$.

This way, the maximization of a representative consumer's utility u is given by the following:

$$\max_{c_A, c_Z} u = \alpha \ln c_A + c_Z, \quad c_A = \left({c_{A_I}}^{\rho} + (\beta c_{A_D})^{\rho}\right)^{\frac{1}{\rho}}, \quad \beta \geq 0, \quad 0 < \rho \leq 1,$$
$$\text{s. t.} \qquad p_A c_A + c_Z = w (\equiv y - t_y)$$

The price of composite goods is normalized as a numéraire good, $p_Z \equiv 1$, and the prices of imported and domestic agricultural goods are given by p_{A_I} and p_{A_D}, respectively. The price index of agricultural goods is expressed by $p_A = \left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}}$, where the elasticity of substitution between domestic and foreign agricultural goods σ is larger than 1, such that $\sigma > 1$. Consumer income is normalized to $y \equiv 1$, and the parameter of agricultural expenditure, α, can be set as the Engel coefficient of the nation (Engel, 1857) or the rate of food expenditure. In this case, the quantities of domestic and imported agricultural goods, c_{A_D} and c_{A_I}, and a tax, t_y, can

be observed as individual expenditure rates. In this asymmetric CES function of domestic and imported agricultural goods, the aggregated quantity, $c_A(c_{A_D}, c_{A_I}) = \left({c_{A_I}}^{\rho} + (\beta c_{A_D})^{\rho}\right)^{\frac{1}{\rho}}$, influenced by the patriot effect's β, is imaged after the national branding of natural, historical, and cultural resources related to rural areas. This quasi-linear utility function $u = \alpha \ln c_A + c_Z$ is composed of the aggregated quantity of agricultural goods, c_A, and composite goods, c_Z. The consumption of agricultural goods is not affected by income effects.

To solve the utility maximization problem of a representative consumer, considering the patriot effect or a strong preferences for national brands, we obtain the quantity of domestic and imported agricultural goods $c_{A_D}$and c_I, aggregate agricultural goods c_A, and composite goods, c_Z.

$$c_{A_D} = \alpha\beta^{-1}\left(\frac{p_{A_D}}{\beta}\right)^{-\sigma} {p_A}^{\sigma-1} = \alpha\beta^{-1}\left(\frac{P_{A_D}}{\beta}\right)^{-\sigma}\left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right]^{-1} \quad (1)$$

$$c_{A_I} = \alpha {p_{A_I}}^{-\sigma} {p_A}^{\sigma-1} = \alpha {p_{A_I}}^{-\sigma}\left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right]^{-1} \quad (2)$$

$$c_A = \alpha {p_A}^{-1} = \alpha\left[{p_{A_I}}^{1-\sigma} + \left(\frac{P_{A_D}}{\beta}\right)^{1-\sigma}\right]^{-\frac{1}{1-\sigma}} \quad (3)$$

$$c_Z = y - t_y - \alpha = 1 - t_y - \alpha \quad (4)$$

Finally, by summing the demand for agricultural and composite goods, we obtain the total demand functions of agricultural and composite goods, which are given by the following:

$$C_{A_D} = \int_0^N c_{A_D}(j)dj = c_{A_D}N = c_{A_D} = \alpha\beta^{-1}\left(\frac{P_{A_D}}{\beta}\right)^{-\sigma}\left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right]^{-1} \quad (5)$$

$$C_{A_I} = \int_0^N c_{A_I}(j)dj = c_{A_I}N = c_{A_I} = \alpha {p_{A_I}}^{-\sigma} {p_A}^{\sigma-1} = \alpha {p_{A_I}}^{-\sigma}\left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right]^{-1} \quad (6)$$

$$C_Z = \int_0^N c_Z(j)dj = c_Z N = c_Z = y - t_y - \alpha = 1 - t_y - \alpha, \quad (7)$$

where the amount of domestic and imported agricultural goods and composite goods is $c_{A_D}(j)$, $c_{A_I}(j)$, and $c_Z(j)$, respectively, for household/consumer j. The number of households N is normalized to 1. Because an open economy is simply assumed to begin with in this paper, the prices of domestic and imported agricultural goods become $p_{A_D} = p_{A_I}$. We discuss that later, including the price of domestic and exported composite goods or numéraire goods, $p_Z \equiv 1$, in section 2.3 of this paper.

(2) The National Branding Index (NBX) and the Self-Support Ratio of Agricultural Goods

National branding by governments heightens the natural, historical, and cultural attractiveness of regions and promote the consumption of regional agricultural goods. As our new interpretation of inter-industry trade, our relative preferences between domestic and imported foods, which are described by the national branding index (NBX) β, change the self-support ratio of agricultural goods λ. It is a traditionally accepted trade theory that the self-support ratio of agricultural goods is explained by correct price differences between domestic and foreign markets. This is depicted as

follows:

(a) **The self-support ratio of agricultural goods**

From the amount of domestic and imported agricultural goods, $p_{A_D}C_{A_D} = p_{A_D}c_{A_D}N = \alpha\left(\frac{p_{A_D}}{p_{A_I}\beta}\right)^{1-\sigma}\left[1+\left(\frac{p_{A_D}}{p_{A_I}\beta}\right)^{1-\sigma}\right]^{-1}$ and $p_{A_I}C_{A_I} = p_{A_I}c_{A_I}N = \alpha\left[1+\left(\frac{p_{A_D}}{p_{A_I}\beta}\right)^{1-\sigma}\right]^{-1}$, the self-support ratio of agricultural goods is obtained as follows:

$$\lambda = \frac{p_{A_D}C_{A_D}}{p_{A_I}C_{A_I}+p_{A_D}C_{A_D}} = \frac{1}{1+\left(\frac{p_{A_D}}{p_{A_I}\beta}\right)^{\sigma-1}},$$

where the price ratio of domestic to foreign markets is $\frac{p_{A_D}}{P_{A_I}}$ and the NBX of domestic agricultural goods is β.

(b) The National Branding Index (NBX) of domestic agricultural goods

The National Branding Index (NBX) of domestic agricultural goods, or the patriot effect, is given by the following:

$$\beta^*(\lambda) = \frac{p_{A_D}}{p_{A_I}}\left(\frac{\lambda}{1-\lambda}\right)^{-\frac{1}{\sigma-1}}$$

This can be observed by correct price differences between domestic and foreign markets $\frac{p_{A_D}}{p_{A_I}}$ and the self-support ratio of agricultural goods λ.

Estimating the following log-linear function:

$$\ln\left(\frac{\lambda}{1-\lambda}\right) = A\ln\frac{p_{A_D}}{p_{A_I}} + B(\beta),$$

we can obtain the slope $A \equiv (\sigma-1)$ and the intercept $B(\beta) \equiv -(\sigma-1)\ln\beta$. The ratio of the consumption of domestic to imported agricultural goods $\frac{\lambda}{1-\lambda}$ is explained by the price ratio of domestic to imported agricultural goods $\frac{p_{A_D}}{p_{A_I}}$ and the NBX β of domestic agricultural goods.

After the establishment of free trade, the self-support ratio of agricultural goods $\lambda = \frac{1}{1+\beta^{1-\sigma}}$ is decided by the patriot effect β, or the NBX, and the variety between domestic and imported agricultural goods.

2.3. Production

The behaviors of the agricultural and composite goods sectors are formalized in this subsection. Rural and urban industries are located strategically to ease the production and supply of agricultural or composite goods. Rural industries supply agricultural goods only to domestic consumers, and urban industries supply composite goods to domestic and foreign consumers. The domestic and international labor productivity of each sector is the same because our discussion focuses only on the patriot effect on national branding and on the trade pattern between the home country and the rest of the world.

(1) Factor of production

The number of laborers per unit of production of agricultural and composite goods is given by $l_{A_D} = {}^{1}/_{\gamma}$ and $l_Z = 1$ when the labor productivity of the composite goods sector is standardized to 1 and that of the agricultural sector γ is less than 1. Here the only factor of production is labor.

(2) Profit maximization

The profits of agricultural and composite goods per unit production, π_A and π_Z, are explained. The free entry of rural and urban industries is assumed to produce agricultural and composite goods under perfect competition and is given by the following:

$$\pi_A = \left(p_{A_D}\gamma - \mathrm{w}_A\right)l_{A_D} = 0 \quad (8)$$

$$\pi_Z = (p_Z - w_Z)l_Z = 0, \quad (9)$$

where each household supplies a laborer to either the agricultural or the composite goods sector, and the wage rate is balanced by $\mathrm{w}_A = w_Z \equiv \mathrm{w} = 1$ in a country where composite goods are numéraire, $p_Z \equiv 1$. The prices of domestic agricultural goods become equal to those of imported ones,$p_{A_D} = p_{A_I} = \frac{1}{\gamma}$. The total number of laborers in the agricultural and composite goods sectors is calculated by $L_{A_D} = l_{A_D}X_{A_D}$ and $L_Z = l_Z X_Z$ when the quantities of domestic and imported agricultural goods to be produced are X_{A_D} and X_Z.

2.4. The Public Sector

Urban and regional economists need to clarify an economic mechanism of generating "agglomeration economies of rural areas" to attain regional revitalization of rural areas. Creating the combined value of natural, historical, and cultural resources is supported as national branding by the Ministry of the Environment and the Agency for Cultural Affairs in the case of Japan. Farmers of each nation are challenged to heighten the value of domestic agricultural goods by using local and regional brand images. The expenditure function of the government is obtained as $\mathrm{G}(\beta) = \Omega\beta$ in this section, where Ω is the governmental expenditure to form one unit of national premium.

(1) Financial Balance

The governmental expenditure $\mathrm{G}(\beta)$ for national branding is used to form the regional premium of domestic agricultural goods, which people like to consume, in other words, the patriot effect β. The place of agricultural production is characterized by its nature, history, and culture. Each household pays a lump-sum tax t_y. The governmental revenue $t_y\mathrm{N}$ from all households is balanced by governmental expenditures for place branding $\mathrm{G}(\beta)$ in Equation (10).

$$\mathrm{G}(\beta) - t_y\mathrm{N} = 0 \quad (10)$$

(2) National Branding by the Government

The national government provides optimal national branding to form the premium β for regional revitalization. We discuss natural, historical, and cultural resources and

the allocation of governmental works depending on the characteristics of the nation.

Each rural area is characterized by a set of natural, historical, and cultural factors $(\overline{\beta_{\mathrm{NA}}}, \overline{\beta_{\mathrm{HI}}}, \overline{\beta_{\mathrm{CU}}})$ and creates agglomeration economies of agricultural and related industries in rural areas. The government needs a labor force for place branding of natural, historical and cultural resources $(\mathrm{L}_{NA}, \mathrm{L}_{HI}, \mathrm{L}_{CU})$. The combined premium of regional resources is expressed by the CES function.

(a) Cost Minimization for National Branding

The cost minimization of place branding by government G is formalized with a constrained condition related to a department's allocation of natural, historical, and cultural work.

$$\min_{\mathrm{L_{NA}},\mathrm{L}_{HI},\mathrm{L}_{CU}} \mathrm{G} = \mathrm{w}(\mathrm{L_{NA}} + \mathrm{L}_{HI} + \mathrm{L}_{CU}) \tag{11}$$

$$\text{s.t } \left[(\overline{\beta_{\mathrm{NA}}}L_{NA})^{\mu} + (\overline{\beta_{\mathrm{HI}}}\mathrm{L}_{HI})^{\mu} + (\overline{\beta_{CU}}\mathrm{L}_{CU})^{\mu}\right]^{\frac{1}{\mu}} = \beta \tag{12}$$

Here, government workers L_G are allocated into some type of place branding, which relates to natural, historical, and cultural resources $(\mathrm{L_{NA}} + \mathrm{L}_{HI} + \mathrm{L}_{CU} \equiv \mathrm{L}_G)$. People protect national agricultural sites that reflect traditional farming methods and indigenous, , natural, historical, and cultural diversity. The parameter of variety among regional resources is expressed by $\mu\left(=\frac{\sigma_B - 1}{\sigma_B}\right)$, where the elasticity of substitution is σ_B. For example, Japanese people have strong preferences for original Japanese Wagyu beef, rice, and fresh vegetables. The value of μ expresses the variety of national branding, which combines the nation's natural, historical and cultural inheritance for the national premium on agricultural goods (Japan Agency for Cultural Affairs, 2016).

(b) The Demand Function of Government Officers for National Branding

The demand of governmental officers related to natural, historical, and cultural resources, $\mathrm{L_{NA}}$, $\mathrm{L_{HI}}$ and $\mathrm{L_{CU}}$, are shown as individual functions of the patriot effect β.

$$\mathrm{L_{NA}}(\beta) = \overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}}\beta \equiv \Omega_{NA}\beta \tag{13}$$

$$\mathrm{L_{HI}}(\beta) = \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}}\beta \equiv \Omega_{HI}\beta \tag{14}$$

$$\mathrm{L_{CU}}(\beta) = \beta_{\mathrm{CU}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}}\beta \equiv \Omega_{CU}\beta \tag{15}$$

In the demand functions of government labor (13)–(15), three proportional coefficients, Ω_{NA}, Ω_{NA}, and Ω_{CU}, indicate the number of natural, historical, and cultural departments' laborers per one unit of the patriot effect.

$$\Omega_{NA} \equiv \overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}} \tag{16}$$

$$\Omega_{HI} \equiv \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}} \tag{17}$$

$$\Omega_{CU} \equiv \beta_{\mathrm{CU}}^{-\frac{\mu}{\mu-1}}\left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{1}{\mu}} \tag{18}$$

(c) The Expenditure Function of National Branding, Derived from Agglomerating

the Economies of Rural Areas

Three demand functions of labor, for the national branding of nature, history, and culture, are shown in equations (13)–(15). The expenditure function of national branding is expressed by the following:

$$\mathrm{G}(\beta) = \mathrm{w}\left(\mathrm{L_{NA}}(\beta) + \mathrm{L}_{HI}(\beta) + \mathrm{L}_{CU}(\beta)\right)$$
$$= \left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{\frac{\mu-1}{\mu}} \beta = \Omega\beta \quad (19).$$

Government expenditures forming one unit of national premium are defined as $\Omega\left(\overline{\beta_{\mathrm{N}}}, \overline{\beta_{\mathrm{H}}}, \overline{\beta_{\mathrm{CU}}}\right) \equiv \left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{\frac{\mu-1}{\mu}}$. The degree of agglomeration economy in a rural area is described as the patriot effect per governmental expenditure $\Omega^{-1}\left(\overline{\beta_{\mathrm{N}}}, \overline{\beta_{\mathrm{H}}}, \overline{\beta_{\mathrm{CU}}}\right) \equiv \left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{HI}}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{\mathrm{CU}}}^{-\frac{\mu}{\mu-1}}\right]^{-\frac{\mu-1}{\mu}}$ by the accumulation of natural, historical, and cultural resources $\left(\overline{\beta_{\mathrm{N}}}, \overline{\beta_{\mathrm{H}}}, \overline{\beta_{\mathrm{CU}}}\right)$.

2.5. Market Equilibrium

We now discuss behaviors of the consumer, agricultural and composite goods sectors, as well as the public sector. Market equilibriums of agricultural goods and factors of production are discussed below. The quantity of domestic agricultural goods demanded $C_{A_D}\left(= c_{A_D}N\right)$ is equal to the quantity supplied X_{A_D}, and the sum of the quantities in domestic and foreign markets $C_Z + C_Z{}^*(= c_Z N + C_Z{}^*)$ is equal to the quantity supplied X_Z. Imported and domestic agricultural goods are recognized as individual, separate markets.

Domestic agricultural goods:	$C_{A_D} = X_{A_D}$	(20)
Composite goods:	$C_Z + C_Z{}^* = X_Z$	(21)
Labor:	$L_A + L_Z + L_G = N$	(22)

Consumers and households, $N(\equiv 1)$, are allocated into three types of labor services, L_A, L_Z and L_G. Each laborer, supplied from each household, obtains income y and pays a lump-sum tax t_y. National income is $\mathrm{Y} = \mathrm{w}(L_A + L_Z + L_G) = \mathrm{w}$, and total taxes of the nation are $T_y = t_y N = t_y$, where the rate of income is w.

2.6. The Foreign Sector

In our small open economy model, composite goods are exported, and agricultural goods $C_{A_I}(\equiv c_{A_I}\mathrm{N})$ are imported. The trade balance between one home country and the rest of the world is shown as:

$$p_Z C_Z{}^* - p_{A_I} C_{A_I} = 0 \quad (23)$$

Here, the price of composite goods is $p_Z \equiv 1$, and the price of imported agricultural goods is presented as $p_{A_I} = \frac{1}{\gamma}$, depending on the productivity of agricultural goods $\gamma(\gamma < 0)$.

3. Political Equilibrium: Implications of National Branding by the

Government

The optimal government behavior maximizes total utility or social welfare, subject to the financial balance between total lump-sum taxes and national branding costs for rural areas. The social welfare function can be defined as the sum of the indirect utility functions over the entire population ($N \equiv 1$). Without discussing trade costs, including transportation costs and tariffs, a general equilibrium model[2] is constructed as follows:

3.1. The Indirect Utility Function

The indirect utility function of a representative consumer v is expressed as $v = \frac{\alpha}{\sigma-1}\ln\left[{p_{A_I}}^{1-\sigma} + \left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma}\right] + 1 + \alpha\ln\alpha - \alpha - t_y$. Substituting the price of domestic and imported goods, $p_{A_I} = p_{A_D} = \frac{1}{\gamma}$ and the financial balance $t_y - \Omega\beta = 0$, we get

$$v(\beta) = \left\{\frac{\alpha}{\sigma-1}\ln(1+\beta^{\sigma-1}) + \alpha\ln\gamma - \alpha(1+ln\,\alpha) + 1\right\} - \Omega\beta \quad (24)$$

3.2. Social Welfare

The government maximizes social welfare W to determine the optimal level of national branding or patriot effect β^*, which forms a combined scenario of natural, historical, and cultural information related to food. The social welfare function can be defined as the sum of the indirect utility functions over the entire population ($N \equiv 1$).

$$\max_{\beta} W(\beta) = \int_0^N v_i(\beta)\,di \quad (25)$$

$$= v(\beta)N = v(\beta) = \left\{\frac{\alpha}{\sigma-1}\ln(1+\beta^{\sigma-1}) + \alpha\ln\gamma - \alpha(1+ln\,\alpha) + 1\right\} - \Omega\beta \quad (26)$$

(1) Targeted optimal level of patriot effect β^*

From the first-order condition

$$\frac{\partial W}{\partial\beta} = \frac{\partial v}{\partial\beta} = \frac{\alpha\beta^{\sigma-2}}{1+\beta^{\sigma-1}} - \Omega = 0 \quad (27) \quad \text{or} \quad \beta^{2-\sigma} + \beta = \alpha\Omega^{-1} \quad (28)$$

$\alpha\Omega^{-1}$, the right side of this equation (28) means "agglomeration economies of a rural area," which is the product of regional resources in a rural area $\Omega^{-1} \equiv \left[\overline{\beta_{\mathrm{NA}}}^{-\frac{\mu}{\mu-1}} +\right.$

[2]From labor demands of the agricultural and composite goods sectors, and the public sector, $L_A = \frac{X_{A_D}}{\gamma} = \frac{c_{A_D}N}{\gamma} = \frac{\alpha}{\gamma\beta}\left(\frac{p_{A_D}}{\beta}\right)^{-\sigma}{p_A}^{\sigma-1}$, $L_Z = X_Z = c_Z N + {C_Z}^* = 1 - t_Y N - \alpha + p_{A_I}c_{A_I}N = \{1-\Omega\beta-\alpha\} + {p_{A_I}}^{1-\sigma}{p_A}^{\sigma-1} = 1 - \alpha - \Omega\beta + \alpha{p_{A_I}}^{1-\sigma}{p_A}^{\sigma-1}$ and $L_G = \Omega\beta$,the total number of laborers are checked as N = 1.

$$\begin{aligned} N = L_A + L_Z + L_G &= \left\{\frac{\alpha}{\gamma\beta}\left(\frac{p_{A_D}}{\beta}\right)^{-\sigma}{p_A}^{\sigma-1}\right\} + \left\{1-\alpha-\Omega\beta+\alpha{p_{A_I}}^{1-\sigma}{p_A}^{\sigma-1}\right\} + \Omega\beta \\ &= \left\{1-\alpha-\Omega\beta+\alpha\left[\left(\frac{1}{\gamma p_{A_D}}\right)\left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma} + {p_{A_I}}^{1-\sigma}\right]{p_A}^{\sigma-1}\right\} + \Omega\beta \\ &= 1-\alpha+\alpha\left[\left(\frac{p_{A_D}}{\beta}\right)^{1-\sigma} + {p_{A_I}}^{1-\sigma}\right]{p_A}^{\sigma-1} = 1 \end{aligned}$$

$\overline{\beta_{HI}}^{-\frac{\mu}{\mu-1}} + \overline{\beta_{CU}}^{-\frac{\mu}{\mu-1}}\Big]^{-\frac{\mu-1}{\mu}}$ and the Engel coefficient α.

The targeted solution β^* is obtained by satisfying the second-order condition $\frac{\partial^2 V}{\partial \beta^2} = -\frac{\alpha\beta^{\sigma-3}}{(1+\beta^{\sigma-1})^2}(-\sigma+2+\beta^{\sigma-1}) < 0$ for any $\beta^*(>0)$ in the case of $1 < \sigma \leq 2$, and is solved by satisfying $\beta^* > (\sigma-2)^{\frac{1}{\sigma-1}}$ in the case of $\sigma > 2$.

Some social welfare functions, $\alpha = 0.3$ and $\Omega = 0.05$, are described in Figure 1. In the case of $\sigma = 3$, solving $\beta^2 - 6\beta + 1 = 0$, we get the maximum point $\beta = 3 + 2\sqrt{2}$, satisfying $\beta^* > 1$. In the case of $\sigma = 2$, solving $\beta^{\frac{1}{2}} + \beta - 6 = 0$, $\beta^* = 5$ is obtained. In the case of $\sigma = 1.5$, solving the equation $\left(\beta^{\frac{1}{2}}\right)^2 + \beta^{\frac{1}{2}} - 6 = 0$, $\beta^* = 4$ is obtained. In the case of $\sigma \to 1$, we get the maximum point $\beta^* = 3$

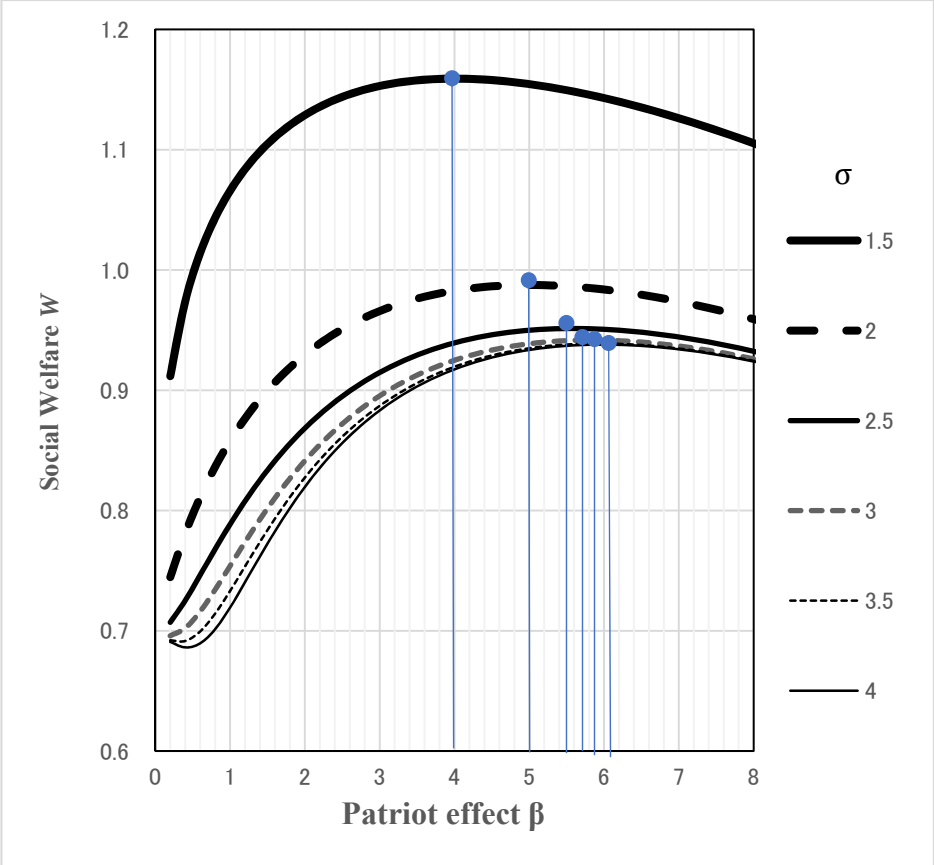

Figure 1. The Social Welfare Function for National Branding ($\alpha = 0.3, \Omega = 0.05$)

(2) **Impact of AI and IoT as the fourth industrial revolution in the field of agriculture**

Moreover, the labor productivity of agricultural goods has been improved by the progress of the fourth industrial revolution, which is based on Artificial Intelligence (AI) and the Internet of Things (IoT). Sensors of temperature and humidity, and video

cameras, are useful in improving agricultural productivity. The difference in productivity between the agricultural and composite sectors becomes smaller using AI and the IoT when social welfare is growing such that $\frac{dW}{d\gamma} = \frac{1}{\gamma} > 0$.

4. Conclusion

Finally, we summarize some important results obtained from the present study. We define and introduce agglomeration economies of rural areas on the basis of place branding. Since the Industrial Revolution, we have observed the concentration of manufacturing and service industries in central business districts with focus only on the localization and urbanization of economies. We introduce the combined agglomeration of urban and rural areas sustainably.

1) This paper proposes a spatial economic model to show how national governments adopt various rural policies to brand regional agricultural goods by the most effective use of the patriot effect. The government holds aloft the national brand image of nature, history, and culture, which leads to the creation of a patriot effect that has the cascading effect of promoting the consumption of traditional or local foods and agricultural goods.
2) The original Armington model (1969) explains that fixed preferences for places of production generate international trade. Our simpler general equilibrium model of a small, open economy can endogenously decide consumer preferences between domestic and imported agricultural goods and trade patterns between the home country and the rest of the world.
3) The optimal number of governmental offices for national branding related to natural, historical, and cultural resources, and the optimal number of agricultural laborers in the rural area and laborers engaged in the manufacture of composite goods in urban areas can be decided.
4) The agglomeration economies of rural areas are generated from the behaviors of consumers and farmers and place branding by governments. Place branding by national and local governments promotes the nature, history, and culture of rural areas in the home country and maximizes the social welfare of people. Consumers form meaningful home-biased images of nature, history, and culture, appreciate the agricultural goods of specific rural areas in their home country, and consume more domestic agricultural goods so as to express their solidarity with areas in their home country.
5) The labor productivity of the agricultural sector when compared with those of other industries has been improved by the progress of the fourth industrial revolution based on AI and IoT. The difference in productivity between the agricultural and composite goods sectors has diminished, and social welfare is developing.

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