INTRA-INDUSTRY TRADE AND NATIONAL ENTRY POLICY

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Abstract. This paper analyzes entry policy in an open economy using an intra-industry trade model. Entry policy is the policy by which a government regulates the number of firms in the country. Implementation of this policy is accompanied by subsidies. In this paper, only one country implements this policy and the other country does not enforce any regulations. We show that the national entry policy makes both countries better off than they would be at the market equilibrium if a certain condition is met. This means that national entry policy is not necessarily a beggar-thy-neighbor policy.

JEL Classification Numbers: D43, F12

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1. INTRODUCTION

Most studies show that the imposition of tariffs is against other countries' interests. That is, imposing tariffs is a beggar-thy-neighbor policy. This result also applies to intra-industry trade models with utility functions of the Dixit–Stiglitz type and monopolistically competitive firms (Venables, 1982, 1987, Helpman and Krugman, 1985, 1989, Flam and Helpman, 1987, Gros, 1987). Export subsidies can have the same effect as imposing tariffs on other countries. Strategic trade policy is also a beggar-thy-neighbor policy.

Compared with tariffs and export subsidies, research on industrial policy in an open economy has made little progress. Industrial policy, especially in economies with preferences for differentiated products and monopolistic competition, has not been sufficiently analyzed, although the topic is interesting. For example, a change in the number of firms affects the variety of

differentiated goods available to consumers. A change in the output of a firm affects its productivity because of increasing returns to scale. Since the 1970s, these aspects of industrial policy have been analyzed in the context of closed-economy models (Dixit and Stiglitz, 1977, Koenker and Perry, 1981, Horn, 1984). These papers showed that governments should increase the number of firms in the monopolistically competitive sector above that prevailing in the market equilibrium. They also showed that such a policy would benefit closed economies.

The policy by which the government regulates only the number of firms in a monopolistically competitive sector is entry policy.[1] If the government increases the number of firms above that prevailing in the market equilibrium, it engages in entry promotion. In this case, firms make losses, which the government must cover with subsidies. Ohyama (1997) analyzed entry policy in an open economy. In his two-country partial equilibrium model, both countries implemented entry policy simultaneously. He found that entry policy was beneficial to each country if a certain condition was met.[2] However, analysis of entry policy should be more general. Hence, we use a general equilibrium model and assume that only one country implements entry policy and that the other country does not enforce any regulations.

Our analysis reveals that national entry policy makes both countries better off when they have similar factor endowment ratios and/or when the elasticity of substitution between differentiated products is small. Therefore, national entry policy is not a beggar-thy-neighbor policy, but is welcomed by other countries. The policy is suitable for developed countries.

When the factor endowment ratios of the two countries differ from each other and when the elasticity of substitution between differentiated products is not small, national entry policy is a beggar-thy-neighbor policy. In this case, the home country can suffer from an increase in its number of monopolistically competitive firms. This result contradicts that of closed-economy models and is counter-intuitive.

It is common knowledge that the use of entry promotion is widespread; for example, the Korean government's support of Posco (Pohang Iron and Steel

Company) is a representative example of entry promotion through subsidies. In addition, in 2002, the British government granted a subsidy of 40 million pounds to Nissan Motor's Sunderland factory, which planned to export cars to Europe. The government granted the subsidies to ensure that Nissan would continue to produce its latest models at the factory. This is a form of entry promotion. Our analysis shows that entry promotion is beneficial not only to the home country but also to other countries.

Currently, trade liberalization and the unification of competitive conditions are frequently negotiated at the World Trade Organization (WTO), Asia Pacific Economic Cooperation (APEC) and other meetings. These negotiations often attempt to reduce subsidies to companies. However, the result of our paper is inconsistent with the aims of these trade negotiations. Our result supports industrial policy under free trade.

In addition, this paper shows national entry policy has global effects. Consequently, this paper suggests that the international coordination of industrial policy is important for avoiding international conflict.

This paper is organized as follows. In section 2, we present the model used in the paper and explain the market equilibrium in an open economy. In section 3, we analyze national entry policy. Section 4 concludes the paper.

2. MARKET EQUILIBRIUM IN AN OPEN ECONOMY

In this section, we explain the market equilibrium in an open economy, using the two-country, two-good, two-factor intra-industry trade model of Lawrence and Spiller (1983).

Consider two economies that have the same type of consumers. The utility functions of the home country and the foreign country are

(2.1-1) $$U = y^{1-s}\left(\sum_{i=1}^{n} x_{1i}{}^{\theta} + \sum_{i=1}^{n^*} x_{2i}{}^{\theta}\right)^{s/\theta},$$

(2.1-2) $$U^* = y^{*1-s}\left(\sum_{i=1}^{n} x_{1i}{}^{*\theta} + \sum_{i=1}^{n^*} x_{2i}{}^{*\theta}\right)^{s/\theta}, \quad 0<\theta, s<1,$$

where y, x_{1i} and x_{2i} are the home country's consumption of the homogeneous good, the ith differentiated good made in the home country and the ith

differentiated good made in the foreign country, respectively. Asterisks (*) denote the foreign country's variables. n and $n*$ are the numbers of firms in the monopolistically competitive sectors of the home and foreign countries, respectively. We assume that each firm produces one type of differentiated good. θ is a constant and $\theta = (\sigma - 1)/\sigma$, where σ is the elasticity of substitution between differentiated products. Hence, θ measures consumer preferences for variety. The greater the desire for variety, the smaller is θ.

The output of a firm in the monopolistically competitive sector, X_{ji}, is defined as

$$X_{ji} = x_{ji} + x_{ji}*, \qquad j=1, \quad i=1,\ldots,n, \text{ and } \quad j=2, \quad i=1,\ldots,n*,$$

where X_{1i} is the output of a firm in the home country and X_{2i} is that of a firm in the foreign country.

The budget constraint in each country is

(2.2-1) $$y + \sum_{i=1}^{n} P_{1i}x_{1i} + \sum_{i=1}^{n*} P_{2i}x_{2i} = Y + \sum_{i=1}^{n} P_{1i}x_{1i} + \sum_{i=1}^{n} P_{1i}x_{1i}*,$$

(2.2-2) $$y* + \sum_{i=1}^{n} P_{1i}x_{1i}* + \sum_{i=1}^{n*} P_{2i}x_{2i}* = Y* + \sum_{i=1}^{n*} P_{2i}x_{2i} + \sum_{i=1}^{n*} P_{2i}x_{2i}*,$$

where P_{1i} is the price of the ith home-made differentiated good, P_{2i} is the price of ith foreign-made differentiated good, and Y and $Y*$ are the outputs of the homogeneous good in the home and foreign countries, respectively. We consider the homogeneous good as the numeraire, and assume its price is unity. Equation (2.2) implies that trade is balanced between the two countries.

Maximizing (2.1) yields the first-order conditions,

(2.3-1) $$P_{ji} = \frac{s}{1-s} y x_{ji}^{\theta-1} \Bigg/ \left(\sum_{i=1}^{n} x_{1i}^{\theta} + \sum_{i=1}^{n*} x_{2i}^{\theta} \right), \qquad j=1,2,$$

(2.3-2) $$P_{ji} = \frac{s}{1-s} y* x_{ji}*^{\theta-1} \Bigg/ \left(\sum_{i=1}^{n} x_{1i}*^{\theta} + \sum_{i=1}^{n*} x_{2i}*^{\theta} \right), \qquad j=1,2.$$

The utility function, the production function and the cost function imply that the solutions for the monopolistically competitive firms' outputs and prices are symmetrical. Thus (2.3) can be written as

(2.4-1), (2.4-2) $$P_1 = \frac{s}{1-s} y \frac{x_1^{\theta-1}}{n x_1^{\theta} + n* x_2^{\theta}}, \quad P_1 = \frac{s}{1-s} y* \frac{x_1*^{\theta-1}}{n x_1*^{\theta} + n* x_2*^{\theta}},$$

(2.4-3), (2.4-4) $P_2 = \frac{s}{1-s} y \frac{x_2^{\theta-1}}{nx_1^{\theta} + n^* x_2^{\theta}}$, $P_2 = \frac{s}{1-s} y^* \frac{x_2^{*\theta-1}}{nx_1^{*\theta} + n^* x_2^{*\theta}}$,

where P_1 is the price of a home-made differentiated good and P_2 is the price of a foreign-made differentiated good.

We assume that the two countries have the same production technology. The production functions for the homogeneous good are

(2.5-1), (2.5-2) $Y = K_y^{\varepsilon} L_y^{1-\varepsilon}$, $Y^* = K_y^{*\varepsilon} L_y^{*1-\varepsilon}$, $0 < \varepsilon < 1$.

where Y is the output, K_y is the capital input and L_y is the labor input in the competitive sector. The first-order conditions for profit maximization are

(2.6-1), (2.6-2) $wL_y = (1-\varepsilon)Y$, $w^* L_y^* = (1-\varepsilon)Y^*$,

(2.7-1), (2.7-2) $rK_y = \varepsilon Y$, $r^* K_y^* = \varepsilon Y^*$.

The cost function for any X_{ji} in each country is

$$TC_{ji} = r\gamma + w\beta X_{ji},$$

where γ is the capital setup cost, r is the rental cost and w is the wage rate. Hence, the production function of a firm can be expressed as $X_{ji} = L_{ji} / \beta$, where L_{ji} is the labor input of the *i*th firm in country *j*. If the number of firms is sufficiently large, the first-order conditions for profit maximization are

(2.8-1), (2.8-2) $P_1\theta = w\beta$, $P_2\theta = w^*\beta$.

The zero-profit conditions are

(2.9-1) $P_1(x_1 + x_1^*) = r\gamma + w\beta(x_1 + x_1^*)$,

(2.9-2) $P_2(x_2 + x_2^*) = r^*\gamma + w^*\beta(x_2 + x_2^*)$.

The endowment constraints are

(2.10-1), (2.10-2) $L = L_y + n\beta(x_1 + x_1^*)$, $L^* = L_y^* + n^*\beta(x_2 + x_2^*)$,

(2.11-1), (2.11-2) $K = K_y + n\gamma$, $K^* = K_y^* + n^*\gamma$,

where L and K are the stocks of labor and capital in the home country.

The sum of both countries' output of the homogeneous good equals the sum of their consumption levels. That is,

(2.12) $Y + Y^* = y + y^*$.

We have assumed that the two countries have the same production technology. We also suppose that factor endowments are distributed so that factor prices are equal. At present, the price of a home-made differentiated good

equals that of a foreign-made differentiated good. In addition, firm outputs in the home and foreign countries are equal. Therefore, $P_1 = P_2$, $w = w^*$ and $r = r^*$. We calculate the number of firms and their outputs using these equations.

We define the economy-wide capital-labor ratio as k, the global factor endowments of capital and labor as K' and L' and the worldwide capital-labor ratio as k'. That is,

$$k = K/L, \quad K' = K + K^*, \quad L' = L + L^*, \quad k' = K'/L' = \delta k,$$

where $\delta = \dfrac{1 + K^*/K}{1 + L^*/L}$. The total number of firms in both countries is

(2.13) $$N = n + n^* = \frac{K'}{\gamma} \cdot \frac{s(1-\theta)}{z},$$

where $$z = s(1-\theta) + (1-s)\varepsilon.$$

In the above equation, z is capital's share of income, and $0 < z < 1$. The output of a firm and that of the homogeneous good are

(2.14), (2.15) $$X = \frac{\gamma}{k'\beta} \cdot \frac{\theta z}{(1-\theta)(1-z)}, \quad Y + Y^* = k'^{\varepsilon} L'(1-s)\left(\frac{\varepsilon}{z}\right)^{\varepsilon}\left(\frac{1-\varepsilon}{1-z}\right)^{1-\varepsilon}.$$

Given the home country's share of world income, $\pi_1 = z \cdot K/(K + K^*) + (1-z) \cdot L/(L + L^*)$, consumption of the differentiated and homogenous goods in the home country are

(2.16) $$x = \pi_1 X = \frac{\theta z \gamma L}{\beta(1-\theta)(K + K^*)}\left(\frac{z}{1-z} \cdot \frac{1}{\delta} + 1\right),$$

(2.17) $$y = \pi_1 (Y + Y^*) = k'^{\varepsilon} L(1-s)(1-\varepsilon)\psi^{\varepsilon}\left(\frac{z}{1-z} \cdot \frac{1}{\delta} + 1\right),$$

where $\psi = \dfrac{\varepsilon(1-z)}{z(1-\varepsilon)}$. Corresponding levels of consumption in the foreign country are $x^* = X - x$ and $y^* = Y + Y^* - y$. Hence, we can determine utility levels in the two countries. We also obtain

(2.18), (2.19) $$w = (1-\varepsilon)(\psi k')^{\varepsilon}, \qquad r = \varepsilon(\psi k')^{\varepsilon - 1}.$$

Equating (2.6-1), (2.7-1), (2.10-1), (2.11-1), (2.18) and (2.19) yields the number of firms in the home country,

(2.20) $$n = \frac{K}{\gamma} \frac{s(1-\theta)}{z} \frac{1 - \psi\delta}{1 - \psi}.$$

This result shows that if $\varepsilon + \theta < 1$, differentiated goods are capital intensive.[3] If $\varepsilon + \theta > 1$, differentiated goods are labor intensive. For now, we assume that $\varepsilon + \theta < 1$. We discuss this assumption later (Lawrence and Spiller, 1983, pp. 68-78).

3. NATIONAL ENTRY POLICY IN AN OPEN ECONOMY

In this section, we analyze national entry policy in an open economy. First, we explain entry policy. Government has the authority to vary or maintain the number of firms in any monopolistically competitive sector in the country. Each firm determines its own profit-maximizing output. If the government increases the number of firms to a number above that prevailing in the market equilibrium, it engages in entry promotion. In this case, firms make losses, which the government must cover with subsidies. Therefore, the government must tax holders of factors of production (workers and owners of capital). This means that the government must transfer income from holders of factors to firms. Entry policy incorporates these measures.

We assume that only one country implements entry policy and that the other country does not enforce any regulations. The home country regulates the number of firms in the country, n. The consumers in both countries maximize their utilities. The firms in both countries maximize their profits. Thus, the number of firms in the foreign country and output and consumption in both countries are determined by the market. At this stage, because the government of the home country must use subsidies (or taxes) to implement entry policy, the price of a home-made differentiated good differs from that of a foreign-made differentiated good; that is, $P_1 \neq P_2$. At the same time, factor prices are not equalized between the two countries; that is, $w \neq w^*$ and $r \neq r^*$. We assume that factors of production are immobile between countries.

In this context, it is appropriate to use the budget constraint (2.2). This is because, when a country's firms are in deficit, the government must tax workers and the owners of capital in that country and give the money to firms. Then, the cost of production for all goods in the home country is equal to the income of workers and the owners of capital, $wL + rK$. The level of production in the home country is $Y + \Sigma_{i=1}^{n} P_{1i} x_{1i} + \Sigma_{i=1}^{n} P_{1i} x_{1i}^*$. If we define the lump-sum transfer from

households to firms as LST, then $LST = wL + rK - (Y + \Sigma_{i=1}^{n} P_{1i} x_{1i} + \Sigma_{i=1}^{n} P_{1i} x_{1i}^{*})$. The level of consumption in the home country is equal to the income of workers and the owners of capital, minus the lump-sum transfer. Thus, $y + \Sigma_{i=1}^{n} P_{1i} x_{1i} + \Sigma_{i=1}^{n^*} P_{2i} x_{2i} = wL + rK - LST$. These expressions yield (2.2). Any profits made by firms accrue to workers and the owners of capital. Subsequently, we again obtain (2.2). Therefore, (2.2) must apply. Note that when (2.2-1) holds, (2.2-2) is redundant because of the Walras' Law.

We now have 19 variables, P_1, P_2, x_1, x_1^*, x_2, x_2^*, y, y^*, Y, Y^*, w, w^*, r, r^*, K_y, K_y^*, L_y, L_y^*, and n^*, which solve the 19 simultaneous equations, (2.2-1), (2.4)-(2.8), (2.9-2) and (2.10)-(2.12).

We define a new variable, t, as

(3.1) $$t = x_2 / x_1 .$$

We substitute tx_1 for x_2 in the 19 equations and solve them (see Appendix 1). Then, we obtain

(3.2) $$n = \frac{K(1-\theta)}{\gamma} \times$$

$$\frac{(1-\varepsilon-\theta)s + (1-\varepsilon)z\frac{L^*}{L}t^{\theta-1} - \varepsilon(1-z)\frac{K^*}{K}t^{(1-\varepsilon)(1-\theta)/\varepsilon}}{(1-\theta)(1-\varepsilon-\theta)s + \varepsilon(1-\varepsilon-\theta)(1-s)t^{(1-\varepsilon-\theta)/\varepsilon} + (1-\varepsilon)(1-\theta)z\frac{L^*}{L}t^{\theta-1} - \varepsilon\theta z\frac{L^*}{L}t^{(1-\varepsilon)(1-\theta)/\varepsilon-1}} .$$

This equation expresses the relationship between n and t. That is, for given n, we can obtain the value of t.[4] We can use these values of n and t to express the other variables, along with the utility levels in both countries.

Let us analyze the effect of national entry policy. At this stage, we assume that the two countries are in market equilibrium. Hence, the home country increases its number of firms and the foreign country does nothing. Given the value of n in (2.20) and given that t =1 in the market equilibrium, the derivatives of utility are

(3.3-1) $$\frac{dU}{dn} = \alpha\gamma\left(\frac{K+K^*}{L+L^*}\right)^{\varepsilon(1-s)-1}\left(\frac{K+K^*}{\gamma}\right)^{s/\theta-s}(1-\varepsilon-\theta)\frac{A}{C},$$

(3.3-2) $$\frac{dU^*}{dn} = \alpha\gamma\left(\frac{K+K^*}{L+L^*}\right)^{\varepsilon(1-s)-1}\left(\frac{K+K^*}{\gamma}\right)^{s/\theta-s}(1-\varepsilon-\theta)\frac{B}{C},$$

where $\alpha = s^{s/\theta}\left\{\frac{(1-s)(1-\varepsilon)}{\theta}\right\}^{1-s}(1-\theta)^{s/\theta-s}\left\{\frac{\varepsilon(1-z)}{z(1-\varepsilon)}\right\}^{\varepsilon(1-s)}\frac{z^{1+s-s/\theta}}{1-z}\frac{1}{\beta}$,

$$A = z\{-\theta+\varepsilon\theta+s(1-\varepsilon-\theta)(1-s+s\theta)\}\frac{L^*}{L}+(1-z)\{\varepsilon\theta+s(1-\varepsilon-\theta)(1-s+s\theta)\}\frac{K^*}{K}$$
$$+s(1-s)(1-\theta)(1-\varepsilon-\theta),$$

$$B = (1-z)\{\varepsilon\theta+s(1-\varepsilon-\theta)(1-s+s\theta)\}\frac{L^*}{L}+z\{-\theta+\varepsilon\theta+s(1-\varepsilon-\theta)(1-s+s\theta)\}\frac{K^*}{K}$$
$$+s(1-s)(1-\theta)(1-\varepsilon-\theta)\frac{L^*}{L}\frac{K^*}{K},$$

$$C = s(1-s)(1-\varepsilon-\theta)^2+z\{(1-\varepsilon)(1-\theta-\varepsilon\theta)-s(1-\varepsilon-\theta)(1+\theta-\varepsilon\theta)\}\frac{L^*}{L}$$
$$+(1-z)\{\varepsilon^2\theta+s(1-\varepsilon-\theta)(1-\theta+\varepsilon\theta)\}\frac{K^*}{K}-\theta(1-\varepsilon)z^2\left(\frac{L^*}{L}\right)^2+z(1-z)(1-\theta+\varepsilon\theta)\frac{L^*}{L}\frac{K^*}{K}.$$

In this context, $C>0$.[5] Recall that we have already assumed that $\varepsilon+\theta<1$. Thus, we can state the following lemma.

Lemma 1. We assume that differentiated goods are capital intensive. When the home country implements a national entry policy at the market equilibrium, the necessary and sufficient condition to change the utility of each country is

$$\frac{dU}{dn}>0 \Leftrightarrow A>0, \qquad \frac{dU^*}{dn}>0 \Leftrightarrow B>0.$$

We examine the signs of A and B. Let h denote the capital-labor differential of the two countries, as follows,

$$h=\frac{K^*/L^*}{K/L}.$$

The economy-wide capital-labor ratio of each country must be less than the capital-labor ratio of the differentiated-good sector. Thus, the following inequality must be satisfied.[6]

(3.4) $$h_1<h<h_2,$$

where

(3.5-1), (3.5-2) $$h_1 = \frac{\theta z(L^*/L) - (1-s)(1-\varepsilon-\theta)}{(1-\theta)(1-z)(L^*/L)}, \quad h_2 = \frac{(1-\theta)(1-z)}{\theta z - (1-s)(1-\varepsilon-\theta)(L^*/L)}.$$

Note that $0 < h_1 < 1 < h_2$.

As functions of h, A and B are

$$A(h) = (1-z)\{\varepsilon\theta + s(1-\varepsilon-\theta)(1-s+s\theta)\}(L^*/L)h$$
$$+ z\{-\theta + \varepsilon\theta + s(1-\varepsilon-\theta)(1-s+s\theta)\}(L^*/L) + s(1-s)(1-\theta)(1-\varepsilon-\theta),$$
$$B(h) = \left[z\{-\theta + \varepsilon\theta + s(1-\varepsilon-\theta)(1-s+s\theta)\} + s(1-s)(1-\theta)(1-\varepsilon-\theta)(L^*/L)\right](L^*/L)h$$
$$+ (1-z)\{\varepsilon\theta + s(1-\varepsilon-\theta)(1-s+s\theta)\}(L^*/L).$$

These equations yield

$$A(1) = s(1-s)(1-\theta)(1-\varepsilon-\theta)(1+L^*/L) > 0,$$
$$B(1) = s(1-s)(1-\theta)(1-\varepsilon-\theta)(1+L^*/L)(L^*/L) > 0,$$
$$A(h_1) = \frac{z(1-s)(1+s)(1-\varepsilon-\theta)(1+L^*/L)}{1-\theta}\left(\frac{s}{1+s} - \theta\right),$$
$$B(h_2) = \frac{z(1-s)(1+s)(1-\varepsilon-\theta)(1+L^*/L)}{\theta z - (1-s)(1-\varepsilon-\theta)(L^*/L)}\left(\frac{s}{1+s} - \theta\right).$$

$A(h)$ is a monotonically increasing function of h, and $A(1)$ is positive. Hence, A is positive at least when h is close to or greater than unity. In addition, if $\theta \le s/(1+s)$, A is positive for any h such that $h_1 < h < h_2$. However, if $\theta > s/(1+s)$, A is negative for some values of h that are less than unity; that is, if the home country is the capital-abundant country.

$B(h)$ is a linear function of h, and both $B(1)$ and $B(0)$ are positive. This means that B is positive at least when h is close to or less than unity. In addition, if $\theta \le s/(1+s)$, B is positive for any h such that $h_1 < h < h_2$. However, if $\theta > s/(1+s)$, B is negative for some values of h that are greater than unity; that is, if the foreign country is the capital-abundant country.

Therefore, when h is approximately unity, and/or when $\theta \le s/(1+s)$, $dU/dn > 0$ and $dU^*/dn > 0$. That is, when the factor endowment ratios of the two countries are similar and/or when the elasticity of substitution between differentiated products is small, $dU/dn > 0$ and $dU^*/dn > 0$. Otherwise, either $dU/dn < 0$ or $dU^*/dn < 0$. If $dU/dn > 0$ and $dU^*/dn < 0$, a national entry policy that increases n lowers the foreign country's utility. If $dU/dn < 0$ and $dU^*/dn > 0$, a policy that decreases n reduces the utility in the foreign country.

Such policies are beggar-thy-neighbor policies.

The smaller is the elasticity of substitution between differentiated products, the smaller θ. Thus, we obtain the following proposition.

Proposition 1. When the factor endowment ratios of the two countries are similar and/or when the elasticity of substitution between differentiated products is small, national entry policy makes both countries better off. Otherwise, national entry policy is a beggar-thy-neighbor policy.

Two countries that are equally developed would have similar factor endowments. In addition, since consumers in developed countries greatly appreciate product differentiation, the elasticity of substitution between differentiated products would be small. Therefore, Proposition 1 implies that national entry policy is suitable for developed countries.

In our analysis, $dU/dn < 0$ is possible. In this case, the home country is worse-off due to an increase in its number of monopolistically competitive firms. This result contradicts that of closed-economy models and is counter-intuitive.

To analyze Proposition 1, we examine the effect of an increase in n on each variable. As Appendix 2 shows, we obtain

(3.6) $$\frac{dt}{dn} = \frac{d}{dn}\left(\frac{P_1}{P_2}\right)^{1/(1-\theta)} = \frac{d}{dn}\left(\frac{w}{w^*}\right)^{1/(1-\theta)} < 0,$$

(3.7-1), (3.7-2) $$\frac{dP_1}{dn} < 0, \qquad \frac{dP_2}{dn} > 0,$$

(3.8-1), (3.8-2) $$\frac{dX_1}{dn} = \frac{d}{dn}(x_1 + x_1^*) > 0, \quad \frac{dX_2}{dn} = \frac{d}{dn}(x_2 + x_2^*) < 0,$$

(3.9-1), (3.9-2) $$\frac{dn^*}{dn} < 0, \qquad \frac{d}{dn}(n + n^*) : ?$$

These inequalities imply that entry policy has positive and negative effects in each country. An increase in n induces both a deterioration in the terms-of-trade and a benefit from increasing returns to scale in the home country. However, whether the total number of firms producing differentiated products

$(n+n^*)$ increases is indeterminate. If the number increases, consumers in both countries benefit. Consequently, dU/dn is positive when the positive effects dominate the negative effects. Similarly, the sign of dU^*/dn depends on the net effect of positive and negative effects in the foreign country.

Using (3.3), we obtain

(3.10)

$$\frac{d(U+U^*)}{dn} = \alpha(1-s)(1-\theta)(1-\varepsilon-\theta)^2\gamma\left(\frac{K+K^*}{L+L^*}\right)^{\varepsilon(1-s)-1}\left(1+\frac{L^*}{L}\right)\left(1+\frac{K^*}{K}\right)\frac{1}{C} > 0$$

This expression is positive. Therefore, a national entry policy that increases the number of firms in the home country has a beneficial effect on world welfare.

The remaining issue is that dU/dn (or dU^*/dn) can be negative only when the home country (or the foreign country) is capital-abundant. To explain this, we revise the assumption that $\varepsilon+\theta<1$ by assuming that $\varepsilon+\theta>1$; that is, the production of differentiated goods is labor intensive.

Under the assumption that $\varepsilon+\theta>1$, Lemma 1 implies

$$dU/dn > 0 \Leftrightarrow A < 0, \qquad dU^*/dn > 0 \Leftrightarrow B < 0.$$

Hence, A and B are negative when the factor endowment ratios of the two countries are similar and/or when the elasticity of substitution is small. Otherwise, A or B is positive. When A (or B) is positive, the home country (or the foreign country) is the labor-abundant country. The signs of the terms in (3.6), (3.7) and (3.8) are reversed. That is, some of the positive and negative effects are reversed. Therefore, the result under the assumption that $\varepsilon+\theta>1$ is the exact opposite of that under the assumption that $\varepsilon+\theta<1$.

In short, under the assumption that $\varepsilon+\theta<1$, dU/dn (or dU^*/dn) can be negative when the home country (or the foreign country) is the capital-abundant country, while under the assumption that $\varepsilon+\theta>1$, dU/dn (or dU^*/dn) can be negative when the home country (or the foreign country) is the labor-abundant country. Therefore, we obtain another important result: dU/dn (or dU^*/dn) can be negative when the home country (or the foreign country) specializes in differentiated goods.[7] In this case, as n increases, U (or U^*) can decrease. Thus, we can state the following proposition.

Proposition 2. A country that specializes in differentiated goods can suffer due to an increase in the number of firms in the home country. By contrast, a country that specializes in homogeneous goods unambiguously gains from an increase in the number of firms in the home country.

If the home country specializes in differentiated goods, the country can suffer from an increase in its number of firms.

A remaining question is why can a country that specializes in differentiated goods suffer from an increase in n?

Equation (3.10) shows that $d(U+U^*)/dn > 0$. Therefore, we suggest that the world does not have excessive entry. There would be excessive entry if $d(U+U^*)/dn < 0$ or $d(U+U^*)/d(n+n^*) < 0$.

When a country specializes in differentiated goods, the ratio of its number of firms to GDP is higher than that in the other country. In other words, the density of firms inside the country is higher than that of the other country. We suppose that this is closely related to our result.

One interpretation is that our result is due to setup costs. An increase in the number of firms increases setup costs. Hence, as the number of firms in the home country increases, some of the capital allocated to producing homogeneous goods is transferred to the monopolistically competitive sector. At the same time, in the foreign country, some of the capital used for producing differentiated goods is re-allocated to the competitive sector. These transfers shift the production possibility frontiers (PPFs). If these shifts due to setup costs have negative effects on each country through their production processes, the country that specializes in differentiated goods would suffer more than would the other country.

Another interpretation is that our result is due to the distortions induced by subsidies (or taxes). We may interpret $t = (P_1/P_2)^{1/(1-\theta)} = (w/w^*)^{1/(1-\theta)}$ as the distortion generated by the difference between (w, P_1) and (w^*, P_2). This distortion implies that the marginal rate of transformation (MRT) in the home country is not equal to that of the foreign country. The distortion would generate negative effects on each country through their production processes. Thus, the

country that specializes in differentiated goods would suffer more.

Although our result represents an interesting aspect of national entry policy, further investigation is needed.

Consequently, a country's national entry policy affects its own utility and that of other countries. Even the policies of small countries affect the utility of larger countries.[8] In this type of world, the international coordination of industrial policy is important for avoiding international conflict.

We must comment on Proposition 1. National entry policy does not continue to raise the utility of both countries forever. We have used numerical calculations to determine the utility levels of both countries when the home country continues to increase its number of firms above the number prevailing in the market equilibrium. The result is as follows. Initially, the utility levels of both countries continue to increase. However, when the number of firms in the home country reaches a certain level, the utility of the home country starts to decrease, whereas that of the foreign country continues to increase. This indicates that the two countries' interests do not always coincide when national entry policy continues to be implemented. This confirms the importance of the international coordination of industrial policy. Without international coordination, national entry policy may generate conflict between countries.

4. CONCLUSION

We obtained the following conclusions. First, national entry policy makes both countries better off when their factor endowment ratios are similar and/or when the elasticity of substitution between differentiated products is small. Otherwise, national entry policy is a beggar-thy-neighbor policy. Thus, the policy is suitable for developed countries.

Second, if the home country specializes in differentiated goods, the country can suffer from an increase in its number of firms. This result contradicts that of closed-economy models.

Third, even small countries may affect the utility levels of other countries. In this type of world, the international coordination of industrial policy is important for avoiding international conflict.

The second result disproves the excess-entry theorem. As Mankiw and Whinston (1986) showed, the theorem does not apply to models of differentiated goods. Our result is consistent with this point.

We have not sufficiently studied the effect of national entry policies that continue to be implemented. In addition, the international political power of countries influences each country's decision making. These issues are subjects for further research.

Notes

1 So far, entry policy and the excess-entry theorem have typically been examined using models of homogeneous goods. See Mankiw and Whinston (1986) and Matsumura (2000).

2 Ohyama (1997) showed that the Nash equilibrium of national entry policy was beneficial to each country if the desire for variety is low. His paper also showed that cooperative promotion of entry was beneficial to each country if the level of desire for variety is high. (Ohyama, 1997, pp.207-8).

3 Factor intensities for differentiated and homogeneous goods are

$$\frac{\gamma}{L_x} = \left\{1 + \frac{(1-s)(1-\varepsilon-\theta)}{\theta z}\right\}k', \qquad \frac{K_y}{L_y} = \left\{1 - \frac{s(1-\varepsilon-\theta)}{z(1-\varepsilon)}\right\}k'.$$

(k' is the worldwide capital-labor ratio.) Therefore, if $\varepsilon + \theta < 1$, differentiated goods are capital intensive.

4 When the value of n is the one in (2.20), t=1.

5 We omit the proof of $C > 0$ because of limitations on space. The proof is available from the author on request.

6 Equation (3.4) is obtained from the inequalities,

$$\frac{K}{L} < \left\{1 + \frac{(1-s)(1-\varepsilon-\theta)}{\theta z}\right\}k', \qquad \frac{K^*}{L^*} < \left\{1 + \frac{(1-s)(1-\varepsilon-\theta)}{\theta z}\right\}k'.$$

The range of h is also limited by the capital-labor ratio in the homogeneous good sector. Although our paper does not consider this limitation, to do so would not substantially affect our results.

7 In the Lawrence and Spiller model, on which our model is based, the home country's net exports of differentiated goods are

$$\frac{LL^*}{1-\varepsilon-\theta}\frac{z(1-\varepsilon)}{K+K^*}\left\{\frac{\varepsilon(1-z)}{z(1-\varepsilon)}\frac{K+K^*}{L+L^*}\right\}^{\varepsilon}\left(\frac{K}{L}-\frac{K^*}{L^*}\right).$$

Thus, the capital-abundant country specializes in the capital-intensive good.

8 In the small-country case, the policy's impact is negligible, as shown below.

$$\lim_{L^*,K^*\to\infty}\frac{dU/dn}{U}=\lim_{L^*,K^*\to\infty}\frac{dU^*/dn}{U^*}=\lim_{L,K\to\infty}\frac{dU/dn}{U}=\lim_{L,K\to\infty}\frac{dU^*/dn}{U^*}=0.$$

However, the following equations reveal that even if the terms-of-trade effect is eliminated, the policy has other effects on both countries.

$$\lim_{L^*,K^*\to\infty}\frac{dU}{dn}=\infty \text{ or } -\infty \text{ if } \theta<s/(1+s), \quad \lim_{L^*,K^*\to\infty}\frac{dU^*}{dn}=\infty \text{ or } -\infty.$$

Appendix 1. Introduction of the derivatives of the utility

Using (2.4) and (3.1), we express x_2^* and P_2 as

(A1.1), (A1.2) $\quad x_2^*=tx_1^*, \qquad P_2=t^{\theta-1}P_1.$

From (2.8) and (A1.2), we have

(A1.3), (A1.4) $\quad P_1/P_2=w/w^*, \qquad w^*=t^{\theta-1}w.$

Substituting (2.5-1), (2.10-1) and (2.11-1) into (2.6-1) yields

(A1.5) $$w=(1-\varepsilon)\left\{\frac{K-n\gamma}{L-n\beta(x_1+x_1^*)}\right\}^{\varepsilon}.$$

Substituting (2.6-2), (2.7-2), (2.8-2), (A1.4) and (A1.5) into (2.9-2), we obtain

(A1.6) $$x_1+x_1^*=\frac{t^{(1-\varepsilon-\theta)/\varepsilon}\varepsilon\theta\gamma}{(1-\varepsilon)(1-\theta)(K-n\gamma)+t^{(1-\varepsilon-\theta)/\varepsilon}\varepsilon\theta\gamma n}\cdot\frac{L}{\beta}.$$

Substituting (2.5-2), (2.10-2), (2.11-2) and (A1.1) into (2.6-2) yields

(A1.7) $$w^*=(1-\varepsilon)\left\{\frac{K^*-n^*\gamma}{L^*-n^*\beta t(x_1+x_1^*)}\right\}^{\varepsilon}.$$

Equating (A1.4), (A1.5), (A1.6) and (A1.7) yields

(A1.8) $$n^*=\frac{(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}-\left\{(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}\right\}\frac{L^*}{L}t^{(\theta-1)/\varepsilon}}{1-\varepsilon-\theta}.$$

Equating (2.2-1), (2.4-1), (2.5-1), (2.8-1), (A1.5), (A1.6) and (A1.8) yields

(A1.9) $$x_1=\frac{L}{\beta}s\theta\frac{(1-\theta)(K/\gamma-n)+\varepsilon nt^{(1-\varepsilon-\theta)/\varepsilon}}{(1-\varepsilon)(1-\theta)(K/\gamma-n)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}}$$

$$\times \frac{1-\varepsilon-\theta}{(1-\varepsilon-\theta)n-(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{(\theta+\varepsilon\theta-1)/\varepsilon}-\varepsilon\theta\frac{L^*}{L}nt^{\theta-1}+(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{\theta}},$$

(A1.10) $$x_1{}^*=\frac{L}{\beta}\cdot\frac{\theta}{(1-\varepsilon)(1-\theta)(K/\gamma-n)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}}$$

$$\times\frac{\left\{\begin{array}{l}(1-s)\varepsilon(1-\varepsilon-\theta)nt^{(1-\varepsilon-\theta)/\varepsilon}-\varepsilon(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{\theta-1}-\varepsilon^2\theta\frac{L^*}{L}nt^{(1-\varepsilon)(1-\theta)/\varepsilon-1}\\+\varepsilon(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{(1-\varepsilon)(1-\theta)/\varepsilon}-s(1-\varepsilon-\theta)(1-\theta)\left(\frac{K}{\gamma}-n\right)\end{array}\right\}}{(1-\varepsilon-\theta)n-(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{(\theta+\varepsilon\theta-1)/\varepsilon}-\varepsilon\theta\frac{L^*}{L}nt^{\theta-1}+(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{\theta}}.$$

In addition, from (2.2-1), (2.12) and (2.4-2), we obtain

(A1.11) $$\{nx_1{}^*+(1-s)n^*x_1{}^*t^{\theta}-sn^*x_1t^{\theta}\}P_1=sY^*.$$

Substituting (2.5-2), (A1.8), (A1.9) and (A1.10) into (A1.11) yields (3.2).

x_2 and $x_2{}^*$ are expressed as $x_2=tx_1$ and $x_2{}^*=tx_1{}^*$. Hence, we have

(A1.12-1), (A1.12-2) $$y=\frac{1-s}{s}x_1(n+t^{\theta}n^*)P_1,\qquad y^*=\frac{1-s}{s}x_1{}^*(n+t^{\theta}n^*)P_1,$$

where $P_1=\frac{\beta}{\theta}(1-\varepsilon)\left\{\frac{(1-\varepsilon)(1-\theta)(K/\gamma-n)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}}{(1-\varepsilon)(1-\theta)}\cdot\frac{\gamma}{L}\right\}^{\varepsilon}$.

Therefore, utility in each country is

(A1.13-1) $$U=\frac{s^s(1-s)^{1-s}\theta^s(1-\varepsilon)^{(1-\varepsilon)(1-s)}}{(1-\theta)^{\varepsilon(1-s)}(1-\varepsilon-\theta)^{s/\theta-s}}\cdot\frac{\gamma^{\varepsilon(1-s)}}{\beta^s}L^{1-\varepsilon(1-s)}$$

$$\times\left\{(1-\theta)\left(\frac{K}{\gamma}-n\right)+\varepsilon nt^{(1-\varepsilon-\theta)/\varepsilon}\right\}\left\{(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}\right\}^{-(1+\varepsilon s-\varepsilon)}\times$$

$$\left\{(1-\varepsilon-\theta)n-(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{(\theta+\varepsilon\theta-1)/\varepsilon}-\varepsilon\theta\frac{L^*}{L}nt^{\theta-1}+(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{\theta}\right\}^{s/\theta-s},$$

(A1.13-2) $$U^*=\frac{(1-s)^{1-s}\theta^s(1-\varepsilon)^{(1-\varepsilon)(1-s)}}{s^{1-s}(1-\theta)^{\varepsilon(1-s)}(1-\varepsilon-\theta)^{s/\theta-s+1}}\cdot\frac{\gamma^{\varepsilon(1-s)}}{\beta^s}L^{1-\varepsilon(1-s)}$$

$$\times\left\{(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)+\varepsilon\theta nt^{(1-\varepsilon-\theta)/\varepsilon}\right\}^{-(1+\varepsilon s-\varepsilon)}$$

$$\times\left\{(1-\varepsilon-\theta)n-(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{(\theta+\varepsilon\theta-1)/\varepsilon}-\varepsilon\theta\frac{L^*}{L}nt^{\theta-1}+(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{\theta}\right\}^{s/\theta-s}$$

$$\times\left\{\begin{array}{l}(1-s)\varepsilon(1-\varepsilon-\theta)nt^{(1-\varepsilon-\theta)/\varepsilon}-\varepsilon(1-\varepsilon)(1-\theta)\left(\frac{K}{\gamma}-n\right)\frac{L^*}{L}t^{\theta-1}-\varepsilon^2\theta\frac{L^*}{L}nt^{(1-\varepsilon)(1-\theta)/\varepsilon-1}\\+\varepsilon(1-\varepsilon)(1-\theta)\frac{K^*}{\gamma}t^{(1-\varepsilon)(1-\theta)/\varepsilon}-s(1-\varepsilon-\theta)(1-\theta)\left(\frac{K}{\gamma}-n\right)\end{array}\right\}.$$

Equation (A1.13-1) can be written as $U(t,n)$. From (3.2), t is written as $t(n)$. Hence, $dU/dn=(\partial U/\partial t)(dt/dn)+\partial U/\partial n$. We set t to unity and replace n with (2.20). Then, we obtain (3.3-1). In the same way, (3.3-2) is derived.

Appendix 2 The signs of (3.6)-(3.9)

(A2.1) $$\frac{dt}{dn}=\frac{d}{dn}\frac{x_2}{x_1}=-\frac{\gamma}{K}\frac{1}{1-\theta}(1-\varepsilon-\theta)z^2\left(1+\frac{L^*}{L}\right)^2\frac{1}{C}<0,$$

(A2.2) $$\frac{dP_1}{dn}=-\frac{\beta\varepsilon(1-\varepsilon-\theta)}{\theta(1-\theta)}\frac{\gamma}{L}\left\{\frac{\varepsilon(1-z)}{z(1-\varepsilon)}\frac{K+K^*}{L+L^*}\right\}^{\varepsilon-1}$$

$$\times\left\{1+\theta(1-\varepsilon)z^2\left(1+\frac{L^*}{L}\right)^2\left(1-\frac{\varepsilon(1-z)}{z(1-\varepsilon)}\frac{1+K^*/K}{1+L^*/L}\right)\frac{1}{C}\right\}<0,$$

(A2.3) $$\frac{dP_2}{dn}=\frac{\beta\varepsilon^2(1-z)(1-\varepsilon-\theta)}{\theta}\frac{\gamma}{L}\left(1+\frac{K^*}{K}\right)\frac{1}{C}\left\{\frac{\varepsilon(1-z)}{z(1-\varepsilon)}\frac{K+K^*}{L+L^*}\right\}^{\varepsilon-1}>0,$$

(A2.4) $$\frac{dX_1}{dn}=\left(\frac{\gamma}{K}\right)^2\frac{\theta(1-\varepsilon-\theta)z^2}{(1-\theta)^2(1-z)}\frac{L}{\beta}\frac{(1+L^*/L)^2}{1+K^*/K}\frac{z(L^*/L)-(1-s)(1-\varepsilon-\theta)}{C}>0,$$

(A2.5) $$\frac{dX_2}{dn}=-\left(\frac{\gamma}{K}\right)^2\frac{\theta(1-\varepsilon-\theta)z^2}{(1-\theta)(1-z)}\frac{L}{\beta}\frac{(1+L^*/L)^2}{1+K^*/K}\frac{1}{C}<0,$$

(A2.6) $$\frac{dn^*}{dn}=-\varepsilon(1-\theta)\frac{L^*}{L}\frac{1+z(L^*/L)+(1-z)(K^*/K)}{C}<0,$$

(A2.7) $$\frac{d}{dn}(n+n^*)=\left(1+\frac{L^*}{L}\right)\times\left[\begin{array}{l}s(1-s)(1-\varepsilon-\theta)^2-z\{\theta(1-\varepsilon)z+\varepsilon(1-\theta)\}(L^*/L)\\+(1-z)\{(1-\theta+\varepsilon\theta)z-\varepsilon(1-\theta)\}(K^*/K)\end{array}\right]:?$$

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