Optimal Strategies for Preferential Trade Agreement considering Rules of Origin against Global Outsourcing

Eui-Hyun Ha*, Young-Han Kim**

Abstract: This paper examines the optimal strategies for preferential trade agreements (PTA) considering the impact of rules of origin (ROOs) as a non-tariff trade barrier by focusing on the strategic effects of ROOs in oligopolistic competition. Based on a model where multinational corporations can reduce the production costs through global outsourcing of intermediate goods, we demonstrate that a bilateral free trade agreement (FTA) in which the technologically dominant supplier of intermediate goods stays out is a unique equilibrium trade regime. In addition, a country with no global outsourcing option prefers to introduce PTA with the strictest ROOs that impose the highest level of local contents requirement. When the country with no global outsourcing option commands market power in designing ROOs mechanism, the producer surplus of the outsourcing firm can be maximized by satisfying the binding condition for the local contents requirements of ROOs. When both countries have access to outsourcing cheaper intermediate goods, ROOs act as non-cooperative strategic trade policies with the prisoners' dilemma-type outcome. These outcomes necessitate the introduction of an international coordination mechanism to avoid the prisoners' dilemma-type equilibrium due to non-cooperative implementation of ROOs.

Keywords: Preferential Trade Agreements (PTAs), PTA formation strategies, Rules of Origin (ROOs), Strategic Effects of ROOs, Welfare Effects of ROOs

JEL Classifications: F13, F15, F12, F55

* Department of Economics, Sungkyunkwan University, haeh2@naver.com
** Corresponding author, Department of Economics, Sungkyunkwan University, kimyh@skku.edu

1. Introduction

With the recent proliferation of preferential trade agreements (PTAs), trade barriers have been significantly reduced at the regional level. However, with the rapid globalization of production networks, the global fragmentation of production processes and the extensive offshoring strategies, rules of origin (ROOs) have emerged as a critical issue, while being criticized as a new version of trade barriers. ROOs become a critical issue during PTA negotiation since products imported from a non-member country might benefit the preferential market access chance which is designed to be provided only to products produced by PTA member countries. To prevent such side effects of PTA formation, ROOs require that all products traded between PTA member countries should satisfy the local contents requirements to be eligible for the preferential market access with the upper ceiling of the imported intermediate goods.

However, the application of ROOs varies among nations in the absence of any unified international rule, thereby providing wide scope for ROOs to be used as a non-tariff barrier due to the opaqueness and intricacy of ROOs details. Most PTAs use ROOs as a protective trade instrument to restrain the import of sensitive products and promote specific domestic industries. The World Trade Organization (WTO) introduced the Harmonized Rules of Origin agreement[1] to reduce the uncertainty involved with ROOs in international trade. This agreement, which took effect in 1995, is designed to provide uniform criteria to determine the origin of all trading goods as a part of the WTO agreement. However, the actual implementation of the agreement has been delayed due to a wide range of differences of interests and perspectives of participating countries with respect to technical details of implementing ROOs.

Based on these backgrounds with increasing criticism against ROOs as de facto protective trade policies, this paper examines paper the optimal strategies for preferential trade agreements (PTA) considering the impact of rules of origin (ROOs) as a non-tariff trade

---

[1] Harmonized Rules of Origin agreement was implemented from July 1995, and WTO took over the issue from World Customs Organization (WCO). The Committee on Rules of Origin (CRO) in WTO is in charge of the issue.

barrier by focusing on the strategic effects of ROOs in oligopolistic competition. Based on a model where multinational corporations can reduce the production costs via global outsourcing of intermediate goods, we demonstrate that a bilateral free trade agreement (FTA) in which the technologically dominant supplier of intermediate goods stays out is a unique equilibrium free trade regime. The intuition behind this result is that when a country has a strong technology monopoly in producing intermediate goods at cheaper price, the country has no incentive to join FTA since her intermediate products are imported with no tariff imposed even if she stays out from the FTA, while she can collect tariff revenue as a non-member country of the FTA. In other words, FTA member countries do not impose import tariffs on the imported intermediate goods when foreign suppliers of intermediate goods have higher technologies supplying the intermediate goods at cheaper prices.

In addition, we show that a country with no global outsourcing option prefers to introduce FTA with the strictest ROOs that impose the highest level of local contents requirement. When the country with no global outsourcing option commands market power in designing ROOs mechanism, the producer surplus of the outsourcing firm can be maximized by satisfying the binding condition for the local contents requirements of ROOs. To determine the protective policy feature of ROOs, we examine the case where a country with no outsourcing option has the power to design ROOs mechanism. Therefore, a country with no outsourcing option has an incentive to protect their incumbent firm by imposing strictest ROOs such as the highest level of local contents requirement.

This paper also demonstrates that when both countries have access to outsourcing cheaper intermediate goods, ROOs act as non-cooperative strategic trade policies with the prisoners' dilemma-type outcome since each country has an incentive to protect her own industry by imposing non-cooperative ROOs with very high local contents requirement. These outcomes necessitate the introduction of an international coordination mechanism to avoid the prisoners' dilemma-type outcome due to non-cooperative implementation of ROOs.

ROOs generally take two formats: 'wholly obtained criterion' and 'substantial transformation criterion'. The former is applied mostly to agricultural and marine products, and assigns the origin of a product to the country that produces the product wholly in the country. The latter is applied mostly to industrial products, and assigns the country of origin

via 'Tariff Shift Rules'[3], 'Value Added Rules'[4] and 'Specific Process Rules'[5], that have been processed in more than two countries.

As there are divergent opinions about the economic effect of ROOs, John & Barcelo (2006) argued that ROOs have been implemented with distortion, complexity, non-transparent and inconsistency. Krueger (1999) showed that ROOs have aggravated the trade diversion effects caused by PTA with evidence demonstrating that Mexican firms exporting to the U.S. have to use more expensive U.S. intermediates in order to meet the ROOs of North American Free Trade Agreements (NAFTA).[6] Cadot et al. (2002) provided evidence that ROOs of NAFTA have restricted the chances for market access to NAFTA markets.

Krishna and Krueger (1995), and Falvey and Reed (1998) showed that ROOs have strictly increased production costs since ROOs have induced the use of more expensive local intermediate goods, eventually reducing the demand level of intermediate goods of member countries. On the contrary, Rosellon (2000) has shown that the demand of the intermediate goods of member countries is ultimately increased with the strict ROOs. However, Ju and Krishna (2005) have shown that overly strict ROOs rather increase the import of intermediate goods from non-member countries. Meanwhile, in an empirical study of ROOs based on a survey of export and import firms, USITC (1985) showed that ROOs incur additional costs of $30,000 ~ $100,000 for trading firms.

This study aims to complement earlier studies with explicit explanation of protective feature of ROOs implemented in PTA based on an oligopoly model where firms are competing with asymmetric capacity for outsourcing cheaper intermediate goods. We analyze the optimum strategies for PTAs considering the effects of ROOs with global outsourcing

---

[3] A country is regarded as the origin of the product when the tariff headings of imported inputs and of outputs are changed over certain units, admitting substantial transformation of the products.

[4] A country of origin is assigned if the value over the certain level of the total value of goods is created in the country of final processing.

[5] If a specific process of the manufacturing process is made in a country, the country is regarded as the origin of the product.

[6] The effect of changing imports from a non-member (low product cost) country to a member (high product cost) country for obtaining preferential tariff, according to the FTA.

strategies in an oligopoly market where firms compete in a Cournot fashion. We consider the case where there are three countries, two of which, *A* and *B*, produce final products while the third, *C*, produces only intermediate goods at a cheaper price with a higher technology than the other two. Only country *B* can outsource intermediate goods from country *C*, while country *A* does not have access to outsourcing intermediate goods from country *C*. When countries negotiate over the formation of PTA while introducing ROOs, we demonstrate that bilateral PTA that excludes a technologically dominant supplier of intermediate goods, country *C*, is a unique equilibrium trade regime. In addition, a country with no global outsourcing option, country *A*, prefers to introduce PTA with the strictest ROOs that impose the highest local contents requirement. When the country with no global outsourcing option, country *A*, commands market power in designing the ROOs mechanism, the producer surplus of the outsourcing firm in country *B* can be maximized by satisfying the binding condition for the local contents requirements of ROOs as decided by country *A*. When both countries have access to outsourcing cheaper intermediate goods, ROOs act as non-cooperative strategic trade policies with the prisoners' dilemma-type outcome. These outcomes necessitate the establishment of an international coordination mechanism to avoid the prisoners' dilemma-type equilibrium due to strategic non-cooperative implementation of ROOs.

This paper is organized as follows. Section 2 describes the model structure. Section 3 examines the equilibrium PTAs when ROOs are introduced, and the welfare effects of ROOs. Section 4 determines optimal strategy to set the minimum local content requirements of ROOs when a country forms PTA with a country that outsources intermediate goods from a technologically dominant country. The welfare effects of ROOs and outsourcing strategy are also examined. Section 5 discusses the policy implications of the major findings and concludes.

2. The Model

This study sets up a standard Cournot oligopoly model, in which there are three countries and a representative firm in each country. We consider a 3-stage game with the following sequence. First, each government decides the optimal trade regime and decides the rules of origin with respect to the preferential tariffs in case PTA is adopted as the optimal trade regime. Secondly, each government decides tariffs with respect to non-member countries. Finally, each representative firm competes in three markets in a Cournot fashion.

The representative firms of countries *A* and *B*, termed firms *A* and *B*, produce both final goods, y, and intermediate goods, x, while one unit of intermediate goods is required for the production of one unit of final goods. The production cost of intermediate goods in each country i is given as C_i. Firm *B* can outsource intermediate goods from country *C* at the cost of $\beta_b C_b$, where $0 < \beta_b < 1$, while the local production cost is C_b. The ratio of the outsourcing among the total provision of intermediate goods is denoted as μ_b. Country *C* produces only intermediate goods depending on firm *B*'s decision on outsourcing strategies of the intermediate goods.

The three markets are segmented, and the inverse demand functions derived from general quasi-linear utility functions are given as follows:

$$Country A, \ B \ : \ P_i = a - b\left(y_i + \sum_{j \neq i}^{n-1} Y_{ji}\right), \ where \ a, b > 0 \tag{1}$$

$$Country C \qquad : \ P_i = a - b\left(\sum_{j \neq i}^{n-1} Y_{ji}\right), \ where \ a, b > 0 \tag{2}$$

The aggregate demand (Y_i) that determines the price (P_i) is the sum of the quantity of domestic production (y_i) and the quantity of imports (Y_{ji}) from *country j* to *country i*. a and b are parameters which denote market size and the level of price elasticity of demand, respectively, and are assumed to be symmetric among countries. The production of each representative firm involves a marginal cost (C_i)[7], and as the level of the global outsourcing

---

[7] Marginal cost (C_i) of country B is given as $C_B = \mu_{bc}\beta_b C_b + (1 - \mu_{bc})C_b$, where C_B is the weighted

of intermediate goods is increased, the marginal cost decreases[8].

The profit function of each representative firm is defined as follows:

$$Country\ A,\ B\ :\ \Pi_i = (P_i - C_i)y_i + \sum_{j \neq i}^{n-1}(P_j - C_i - t_{ji})Y_{ij} \tag{3}$$

$$Country\ C\ :\ \Pi_c = (\beta_{bc}C_b - C_c)\mu_b(Y_{ba} + Y_{bc}) + (\beta_{bc}C_b - C_c - t_{bc})\mu_b y_b \tag{4}$$

where t_{ji} is the import tariff that $country\ j$ imposes on the imports from $country\ i$.

In equation (3), the first term on the right hand side is the domestic firm's profit from the domestic market, and the second term is the producer's profit from exports. Equation (4) describes the nominal profits of the producer of the intermediate goods in country C. Since this paper is mainly concerned with the issue on the impact of ROOs, which penalizes the outsourcing strategies among PTA member countries, the profit maximization problem of firm C is not considered in this paper.

Market equilibrium is derived from backward induction. First, the equilibrium outputs are determined from the following profit maximization problem of the representative firms.

$$Max\Pi_i(y_i, Y_{ij};\ t^*) = (P_i - C_i)y_i + \sum_{j \neq i}^{n-1}(P_j - C_i - t_{ji}^*)Y_{ij} \tag{5}$$

---

production cost of intermediate goods including the global outsourcing. C_b is the local production cost of intermediate goods in country B, and μ_b is the share of the global outsourcing among the total provision of intermediate goods. β measures the rate of cost reduction by outsourcing intermediate goods. Therefore, $\beta_{ij}C_i$ is the price of the intermediate goods paid by a firm in country i to the supplier of the intermediate goods in country j.

[8] For country C, the price ($\mu_b \beta_{bc} C_b$) of intermediate goods (x) is determined by global sourcing strategies of country B. If country B produces all intermediate goods by local production, μ_b is 0, while if country B outsources all intermediate goods, μ_b is 1.

$$F.O.C \frac{\partial \Pi}{\partial y_i} = 0, \quad \frac{\partial \Pi}{\partial Y_{ij}} = 0$$

From the above profit maximization problem, the equilibrium outputs are given as follows:

$$Country\ A: \ y_a^* = \frac{1}{3b}(a - 2C_a + (\beta_{bc} - 1)\mu_b C_b + t_{ab}^*) \tag{6}$$

$$Y_{ab}^* = \frac{1}{3b}(a - 2C_a + (\beta_{bc} - 1)\mu_b C_b - 2t_{ba}^*) \tag{7}$$

$$Y_{ac}^* = \frac{1}{3b}(a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b - 2t_{ca}^* + t_{cb}^* \tag{8}$$

$$Country\ B: \ y_b^* = \frac{1}{3b}(a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b + t_{ba}^*) \tag{9}$$

$$Y_{ba}^* = \frac{1}{3b}(a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b - 2t_{ab}^*) \tag{10}$$

$$Y_{bc}^* = \frac{1}{3b}(a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b - 2t_{cb}^* + t_{ca}^*) \tag{11}$$

A firm's equilibrium outputs are always increased with the import tariffs imposed on competing foreign firms, $(\frac{\partial y_i^*}{\partial t_{ij}^*} = \frac{1}{3b} > 0)$, while the exports are reduced with the import tariffs of the importing countries, $(\frac{\partial Y_{ij}^*}{\partial t_{ji}^*} = -\frac{2}{3b} < 0)$. Moreover, exports are increased with the import tariffs imposed on the third country's products, $(\frac{\partial Y_{ij}^*}{\partial t_{jk}^*} = \frac{1}{3b} > 0)$.

The social welfare function of country i is defined as the sum of consumer surplus, producer surplus and tariff revenue of the government, as follows:

$$W_i(t_{ij}) = [aY_i - \frac{b(Y_i)^2}{2} - P_i Y_i] + \Pi_i + \sum_{j \neq i}^{n-1} t_{ij} Y_{ji} \tag{12}$$

The first term on the right hand side in equation (12) is consumer surplus, which is derived from a linear inverse demand function. The second term is producer surplus, which is the sum of the profit of the domestic market and export profits. The third term is tariff

revenue. Under the assumption of segmented markets, the export profit is unaffected by the domestic tariff, but is affected by the tariff of the importing country. Basically, imposing a tariff reduces consumer surplus, as the price of imported goods increases, which then increases the domestic profit of a domestic firm.

For a benchmarking discussion, we examine the case without any formation of PTAs. In this case, each country imposes non-cooperative Nash tariffs to maximize its social welfare in a non-cooperative way.[9] Optimal tariffs are derived from the social welfare maximization problems as follows:

$$t_i^{NC} = argMaxW_i^{NC}(t_i) \tag{13}$$

In the case of non-cooperative trade regime (NC), the optimum tariff level of each country is as follows.

$$CountryA \;:\; t_{ab}^{NC} = \frac{1}{3}(a - C_b + \mu_b C_b - \beta_{bc}\mu_b C_b) \tag{14}$$

$$CountryB \;:\; t_{ba}^{NC} = \frac{1}{3}(a - C_a), \;\; t_{ba}^{NC} = 0 \tag{15}$$

$$Country\ C \;:\; t_{ca}^{NC} = \frac{1}{11}(a - 5C_a + 4C_b - 4\mu_b C_b + 7\beta_{bc}\mu_b C_b + 7t_{cb}^*),$$

$$t_{cb}^{NC} = \frac{1}{11}(a + 4C_a - 5C_b + 5\mu_b C_b - 11\beta_{bc}\mu_b C_b + 7t_{ca}^*) \tag{16}$$

Reflecting the vertical value chains between countries *B* and *C*, country *B* imposes no tariff on the imports from country *C* since intermediate goods are imported to reduce the production costs of firm *B*. When the above equilibrium tariffs are substituted to the profit maximization problem of firms *A* and *B*, the equilibrium outputs for the domestic market and exports for firms *A* and *B* are given as follows:

---

[9] The case where non-cooperative Nash tariffs are imposed without any arrangement of preferential trade agreements is different from the case where Most Favored Nation clause (MFN) tariffs are imposed. When MFN tariffs are imposed, there should be no discrimination of tariffs among WTO member countries, while the non-cooperative Nash tariffs are imposed in different levels depending on the trade partner to maximize the social welfare in a non-cooperative way. However, MFN tariffs and non-cooperative tariffs share the common feature that the preferential trade arrangements are not considered.

$$\textit{Country A}: y_a^* = \frac{1}{9b}(4a - 7C_a + 3C_b - (C_a - 3C_b)(\beta_{bc} - 1)\mu_b) \tag{17}$$

$$Y_{ab}^* = \frac{1}{9b}(a - 4C_a + 3C_b(1 + (\beta_{bc} - 1)\mu_b) \tag{18}$$

$$Y_{ac}^* = \frac{1}{24b}(6a + 8C_b(1 + (\beta_{bc} - 1)\mu_b + C_a(5\mu_b - 8\beta_{bc}\mu_b - 14)) \tag{19}$$

$$\textit{Country B}: y_b^* = \frac{1}{9b}(4a + 2C_a - 6(C_b + (\beta_{bc} - 1)\mu_b C_b)) \tag{20}$$

$$Y_{ba}^* = \frac{1}{9b}(a + 5C_a - 6C_b + 2(C_a - 3C_b)(\beta_{bc} - 1)\mu_b) \tag{21}$$

$$Y_{bc}^* = \frac{1}{24b}(6a - 16(C_b + C_b(\beta_{bc} - 1)\mu_b + C_a(16\beta_{bc}\mu_b - 7\mu_b + 10)) \tag{22}$$

3. The impacts of rules of origin (ROOs) **on the formation of preferential trade agreements** (PTAs) **and social welfare**

A variety of international trade regimes are possible among three countries. The first case is the non-cooperative trade regime where each country decides its tariffs in a non-cooperative way separately with no coalition. The second option is the case of bilateral PTA with one country remaining as an outsider. The third possibility is the case of hub & spoke-type PTA where one country arranges bilateral free trade agreement (FTA) with two countries while the two countries do not arrange any coalition. The last option is the case where all three countries form a free trade regime, which might be called a global free trade regime (GFT). The details of the possible trade regimes are as follows:

$$\textit{Non} - \textit{Cooperative Trade regime} - (1): \{A, B\ C\}$$

$$\textit{Bilateral FTA} - (2): \{(A, B), C\}, \ (3): \{(A, C), B\}, \ (4): \{A, (B, C)\}$$

$$Hub \ \& \ Spoke \ type \ FTA-(5): \{(\,A,B\,),(\,A,C\,)\},$$
$$(6)::\{(\,A,B\,),(\,B,C\,)\}, \quad (7):\{(\,A,C\,),(\,B,C\,)\}$$

$$GFT-(8): \{(\,A,B \ C\,)\}$$

For a trade regime to be an equilibrium regime, each country should have no incentive to deviate from the trade regime. In other words, the welfare level from each trade regime should be the same or higher than the reservation welfare level, i.e., the welfare level from the non-cooperative trade regime. First, we examine the welfare level of each trade regime when the ROOs are not applied assuming that firm B outsources 50% of total intermediate goods from country C at the half cost of domestic production, i.e., at the 50% of the domestic production cost.

The details of the equilibrium welfare level of 8 cases of trade regimes are given in < Table 1 > based on parameter values assuming that production costs for intermediate goods in countries A and B are symmetric, ($C_a = C_b = 1$), while firm B outsources 50% of total intermediate goods from country C at 50% of domestic production cost. As noted in <Table 1>, countries A and B prefer the hub & spoke-type FTA regime where each country plays the role of hub while country C has no incentive to join the FTA since the reservation welfare level from the non-cooperative trade regime is higher than that from the FTA regime. Therefore, hub & spoke-type FTAs cannot be equilibrium trade regimes.

The only trade regime where no country has any incentive to deviate from is the bilateral FTA between *A&B* where country *C* stays out of FTA as an outsider country. The intuition behind the fact that country *C* prefers to stay out of the bilateral FTA between A&C as an outsider is that firm *C*'s export of intermediate goods to country *B* is increased due to the increased sales of firm B's final goods after the FTA formation. In addition, even if country *C* stays as an outsider country of the FTA, country *B* does not impose import tariffs on the imported intermediate goods from country *C* to reduce the production cost of firm B, because firm *C* has a technology monopoly to produce the intermediate goods at the half cost of country *B*.

In addition, countries A and B have incentives to join the GFT regime while country C prefers to stay out of free trade agreement regime. Therefore, the GFT regime cannot be an

equilibrium trade regime. The rationale behind this result is that firm C enjoys free market access to country B even without joining any free trade regime due to its technology monopoly power in producing intermediate goods at half the production cost, while country C loses tariff revenues with no additional market access opportunities when it joins any free trade regime.

<Table 1> Social welfare of trade regimes when rules of origin (ROOs) are not applied

Case	Country A	Country B	Country C
(1) Non-cooperative trade regime	74.7786	80.4144	45.4826
(2) Bilateral FTA between *A&B*	80.605	89.0009	**46.0104**
(3) Bilateral FTA between *A&C*	85.4563	82.4325	42.0025
(4) Bilateral FTA between *B&C*	76.5978	92.0864	42.0025
(5) Hub (*A*) & Spoke-type FTA	**91.2827**	91.0189	42.5303
(6) Hub (*B*) & Spoke-type FTA	82.4242	**100.673**	42.5303
(7) Hub (*C*) & Spoke-type FTA	82.2222	88.5872	41.2292
(8) Global free trade (GFT) regime	88.0486	97.1736	41.7569

$* a = 10, \quad b = 0.5, \quad C_a = 1, \quad \mu_b = 0.5, \quad \beta_{bc} = 0.5$

Now, we examine the equilibrium trade regime based on the welfare analysis of 8 different trade regimes when ROOs are applied. We assume that ROOs are applied such that only when the ratio of intermediate goods outsourced from non-member countries is lower than 50%, the products are regarded as local products. Otherwise, the products are regarded as foreign products and import tariffs are imposed even if they are produced within the member countries of PTA. < Table 2 > shows the welfare levels of the three countries in 8 trade regimes when ROOs are applied assuming that firm B outsources 50% of intermediate goods from country C. According to ROOs, even after countries A and B form a bilateral FTA, country A imposes tariffs on imports from country B since firm B outsources 50% of intermediate goods, while products of country A are imported to country B with no tariff imposed.

As shown in <Table 2>, when ROOs are applied, country A prefers the trade regime where country A plays the role of hub of FTA agreements, regime (5), while countries B and

C have strong incentives to deviate to a non-cooperative trade regime. Country B prefers the GFT regime to PTA since ROOs of PTAs do work as a market entry barrier, while the GFT regime imposes no entry barrier against firm *B*. However, the GFT regime cannot be an equilibrium trade regime since country C has an incentive to deviate to the non-cooperative trade regime. The intuition behind this result is the same as before in that country C does not obtain any additional market access chances from free trade arrangements due to firm C's pre-existing technological monopoly power, while country C loses the tariff revenue when it joins any free trade regime.

Therefore, when ROOs are applied and imports from country B do not satisfy the minimum local content requirement, there is no equilibrium free trade regime, and therefore, the non-cooperative trade regime is the unique equilibrium trade regime, as shown in < Table 2 >. However, even if ROOs are applied, when the imported products from country B satisfy the local contents requirements of ROOs, bilateral FTA between A&B is the unique free trade equilibrium. < Table 3 > shows the social welfare levels of the 8 cases of trade regime when ROOs are satisfied with the ratio of the local provision of intermediate goods being higher than the minimum local contents requirement of ROOs, $1 - \mu_b = 0.6 > \lambda_{ab} = 0.5$. When ROOs are satisfied, neither country A nor country B has any incentive to deviate from the bilateral FTA between countries A and B, and the social welfare of the non-member country, country C, is also improved, as shown in <Table 3 >.

Therefore, even if ROOs are introduced, as long as the local content requirements are satisfied, bilateral FTA between A and B is the unique equilibrium free trade regime. However, when the local contents requirements are not satisfied, there is no equilibrium free trade regime, implying that excessively strict application of ROOs serves as a barrier against a free trade regime.

<Table 2>Social welfare of trade regimes when rules of origin (ROOs) are not satisfied

Case	Country A	Country B	Country C
(1) Non-cooperative trade regime	74.7786	80.4144	**45.4826**
(2) Bilateral FTA between *A&B*	90.112	71.4144	44.9826
(3) Bilateral FTA between *A&C*	85.4563	82.4325	42.0025
(4) Bilateral FTA between *B&C*	76.5978	92.0864	42.0025
(5) Hub (*A*) & Spoke-type FTA	**100.79**	73.4325	41.5025
(6) Hub (*B*) & Spoke-type FTA	91.9311	83.0864	41.5025
(7) Hub (*C*) & Spoke-type FTA	82.2222	88.5872	41.2292
(8) Global free trade (GFT) regime	88.0486	**97.1736**	41.7569

$note : a = 10, \quad b = 0.5, \quad C_a = 1, \quad \mu_b = 0.5, \quad \beta_{bc} = 0.5$

<Table 3>Social welfare of trade regimes when ROOs are satisfied

Case	Country A	Country B	Country C
(1) Non-cooperative trade regime	74.8303	81.1417	44.9771
(2) Bilateral FTA between *A&B*	80.4203	90.0528	**45.4038**
(3) Bilateral FTA between *A&C*	85.5079	83.1597	41.497
(4) Bilateral FTA between *B&C*	76.6929	93.1267	41.3361
(5) Hub (*A*) & Spoke-type FTA	**91.0979**	92.0708	41.9236
(6) Hub (*B*) & Spoke-type FTA	82.2829	**102.038**	41.7627
(7) Hub (*C*) & Spoke-type FTA	82.08	89.7389	40.6233
(8) Global free trade (GFT) regime	87.67	98.65	41.05

$note : a = 10, \quad b = 0.5, \quad C_a = 1, \quad \mu_b = 0.5, \quad \beta_{bc} = 0.5$

Now, we examine the impact of increasing level of outsourcing, μ_b, on social welfare. When ROOs are not applied, it is shown that as the level of outsourcing by firm B is increased, the social welfare of country B increases sharply as the biggest beneficiary of the outsourcing with the country C's welfare increasing, too. Nonetheless, the social welfare of country A is not affected significantly since the positive impact on the consumer surplus due to increasing level outsourcing is counterbalanced by the negative impact on firm A's profits.

When ROOs are applied with the local contents requirement, λ_{AB}, being 50%, if $\mu_b \in [0, \frac{1}{2})$, the social welfare levels of the three countries are the same as the case when ROOs are not applied. However, when the ratio of the outsourcing reaches 50%, country A imposes non-cooperative tariffs on imports from country B. With the tariff imposition, the social welfare of country B drops since the producer surplus of firm B drops sharply with no change in the surpluses of other sectors. In the meantime, the social welfare of country A increases with the tariff imposition since the producer surplus of firm A is sharply increased with the strategic advantage given by the tariff imposition on the competing firm B. The consumer surplus of country A is decreased with the imposition of the tariff, while the increase in the producer surplus dominates decrease in the consumer surplus. Therefore, the social welfare of country A jumps up at $\mu_b = \frac{1}{2}$, as shown in <Figure 1>.

When $\mu_b \in [\frac{1}{2}, 1]$ with ROO applied, the social welfare of country B increases after a sharp drop at $\mu_b = \frac{1}{2}$. Although the producer surplus is sharply decreased with the tariff imposition by country A, the producer surplus of firm B increases with the deepening outsourcing, μ_b, since the production cost of firm B decreases with the increasing μ_B. At the same time, the social welfare of country C also increases after a drop at $\mu_b = \frac{1}{2}$, since the producer surplus of firm C is proportional to the amount of intermediate goods outsourced by the firm B.

<Figure 1> The impact of deepening outsourcing (μ_b) on social welfare

< When ROO is not applied >   < When ROO is applied >

15

Now we examine the impact of the cost reduction effect of outsourcing on the social welfare of member countries of FTA, countries A and B, and outsider country C. The cost reduction effect of outsourcing is denoted as the reduction of the original cost at the rate of β_{bc}. Therefore, as β_{bc} increases, the cost reduction effect of outsourcing is dampened. As shown in <Figure 2>, when the ROOs are not applied, the social welfare of country B decreases with the higher β_{bc}, i.e., the lower cost reduction effect of outsourcing, although the welfare level still dominates the welfare of country A. The impact of increasing β_{bc} on the social welfare of country A is limited since the positive impacts on the producer surplus of country A are counterbalanced by the negative impacts on the consumer surplus of country A. When the ROOs is applied, with the increasing β_{bc}, the social welfare of country B decreases while the welfare level of country A dominates the welfare of country B since the strategic advantage of firm A due to the tariff imposition by country A.

<Figure 2> Cost reduction effect of outsourcing on social welfare

< When ROO is not applied >   < When ROO is applied >

4. Optimal rules of origin (ROOs) and outsourcing strategies under preferential trade agreements (PTAs).

We examine the optimal ROOs for country *A* and the optimal outsourcing strategy for firm *B* when countries *A* and *B* arrange an FTA with country *C* as an outsider, as determined as a unique equilibrium free trade regime in the earlier section. Since only firm *B* outsources intermediate goods while firm *A* is supplied only with the domestic intermediate goods, the ROOs of country *B* are not considered while focusing on the optimal outsourcing strategy of firm *B*.

Country *A* decides the minimum level of local content requirements of ROOs, λ_{ji}. If the ratio of the outsourcing intermediate goods by firm B, μ_b, is lower than $1 - \lambda_{ji}$, country *A* does not impose any tariff on goods from country *B*, while non-cooperative tariffs are imposed if $1 - \mu_b < \lambda_{ab}$. The profit function of firm *B* is defined as follows:

$$\Pi_i = \left(P_i - \left(\beta_{ij}C_i\mu_i + (1 - \mu_i)C_i\right)\right)y_i + \left(P_j - \left(\beta_{ij}C_i\mu_i + (1 - \mu_i)C_i\right) - \tau_i t_{ji}^*\right)Y_{ij}$$
$$+ \left(P_k - \left(\beta_{ij}C_i\mu_i + (1 - \mu_i)C_i\right) - t_{ki}^*\right)Y_{ik} \tag{23}$$

where, $\tau_i = 0$ if $1 - \mu_i > \lambda_{ji}$ and $\tau_i = 1$ if $1 - \mu_i \leq \lambda_{ji}$.

As defined in equation (23), country *A* imposes non-cooperative tariffs only when firm *B*'s local provision of the intermediate goods, $1 - \mu_b$, is lower than the minimum level of local contents requirements, λ_{ab}, of country *A*'s ROOs. For country *A*'s products, no tariff is imposed since firm *A* does not outsource intermediate goods. The higher the ratio of outsourcing, μ_i, the lower is the marginal cost since $\beta_{ij} < 1$.

The equilibrium outputs of firm *A* and *B* are given as follows when ROOs are satisfied with $1 - \mu_b \geq \lambda_{ab}$, and therefore, country *A* does not impose any tariff on imports from country *B*.

<Equilibrium outputs when ROOs are satisfied $(1 - \mu_b \geq \lambda_{ab})$ >

$$Country \; A : y_a^* = \frac{1}{9b}(4a - 7C_a + 3C_b - (C_a - 3C_b)(\beta_{bc} - 1)\mu_b) \tag{24}$$

$$Y_{ab}^* = \frac{1}{3b}(a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b) \tag{25}$$

$$Y_{ac}^* = \frac{1}{24b}(6a - 14C_a + 8C_b + ((5 - 8\beta_{bc})C_a + 8(\beta_{bc} - 1)\mu_b C_b \tag{26}$$

$$Country \; B : y_b^* = \frac{1}{3b}(a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b) \tag{27}$$

$$Y_{ba}^* = \frac{1}{9b}(a + 5C_a - 6C_b + 2(C_a - 3C_b)(\beta_{bc} - 1)\mu_b) \tag{28}$$

$$Y_{bc}^* = \frac{1}{24b}(6a + 10C_a - 16C_b + (-16C_b(\beta_{bc} - 1) + (16\beta_{bc} - 7)\mu_b C_a)) \tag{29}$$

When ROOs are not satisfied with $1 - \mu_b < \lambda_{ab}$, country A imposes tariffs on imports from country *B*, and the equilibrium outputs are given as follows:

<Equilibrium outputs when ROOs are not satisfied $(1 - \mu_b < \lambda_{ab})$ >

$$Country \; A : y_a^* = \frac{1}{3b}(a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b) \tag{30}$$

$$Y_{ab}^* = \frac{1}{3b}(a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b) \tag{31}$$

$$Y_{ac}^* = \frac{1}{24b}(6a - 14C_a + 8C_b + ((5 - 8\beta_{bc})C_a + 8(\beta_{bc} - 1)\mu_b C_b)) \tag{32}$$

$$Country \; B : y_b^* = \frac{1}{3b}(a + 2C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b) \tag{33}$$

$$Y_{ba}^* = \frac{1}{3b}(a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b) \tag{34}$$

$$Y_{bc}^* = \frac{1}{24b}(6a + 10C_a - 16C_b + (-16(\beta_{bc} - 1)C_b + (16\beta_{bc} - 7)\mu_b C_a)) \tag{35}$$

The bilateral FTA between countries *A* and *B*, Case (2) of trade regimes, is the unique equilibrium free trade regime, as shown in the earlier section. Under the bilateral FTA between countries *A* and *B*, the social welfare of countries *A* and *B* is maximized when ROOs are satisfied with the whole range of outsourcing of firm *B*, as shown in <Table 4 >.   <Table 4> shows three cases of outsourcing of firm *B*, from the lowest level of outsourcing, $\mu_b = 0.1$, to the highest level of outsourcing, $\mu_b = 0.8$. In all three cases, the social welfare of countries *B* and *A* is maximized when ROOs are satisfied, implying that the strict application of ROOs with a higher local content requirement by country *A* reduces not only the welfare of country *B*, but the welfare of country *A* itself as a protective trade policy.

The feature of ROOs as a protective trade policy is shown in a more explicit way in <Table 5> and <Table 6>. It is shown that the producer surplus of country *A* is maximized when ROOs are most strictly applied with the local contents requirements being higher than 90%, i.e., $\lambda_{ab} > 0.9$. In such a case, ROOs of country *A* cannot be satisfied, and therefore, import tariffs will be imposed by country *A* on the imports from country *B* even if firm *B*'s share of outsourcing remains as low as 0%, $\mu_b = 0.1$. In <Table 5>, the producer surplus of country *A* is maximized when ROOs are not satisfied with $\mu_b = 0.1$, implying that country *A*'s local contents requirement is higher than 90%. In terms of consumer surplus, the strict application of ROOs, which induces a lower level of firm *B*'s outsourcing or the imposition of import tariffs on firm *B*'s products, lowers country *A*'s consumer surplus, as shown in < Table 6>.

The overall impact of stricter application of ROOs, which induces a lower level of firm *B*'s outsourcing or the imposition of import tariffs on firm *B*'s products, on country *A*'s welfare is positive. The rationale behind this result is that the positive impacts on the

producer surplus by introducing more strict ROOs dominate the negative impact of stricter application of ROOs on the consumer surplus mainly due to the strong strategic impacts of ROOs on the producer surplus of firm *A* competing with firm *B* that can benefit from outsourcing intermediate goods at cheaper production cost from country *C*, which is not available to firm *A*.

<Table 4> Social welfare when ROOs are applied

	Country	*Country A*	*Country B*
$\mu_b = 0.1$	When ROOs are satisfied (No tariff imposed on country *B*)	81.8142	**83.47**
	When ROOs are not satisfied (Tariffs imposed on country *B*)	**90.9145**	67.1577
$\mu_b = 0.5$	When ROOs are satisfied	80.605	**89.0009**
	When ROOs are not satisfied	**90.112**	71.4144
$\mu_b = 0.8$	When ROOs are satisfied	79.7339	**93.3072**
	When ROOs are not satisfied	**89.5517**	74.7393

* $a = 10$, $b = 0.5$, $C_a = 1$, $\beta_{bc} = 0.5$

<Table5> Producer surplus when ROOs are applied

	Country	*Country A*	*Country B*
$\mu_b = 0.1$	When ROOs are satisfied (No tariff imposed on country *B*)	45.6139	**47.2698**
	When ROOs are not satisfied (Tariffs imposed on country *B*)	**59.6358**	30.9574
$\mu_b = 0.5$	When ROOs are satisfied	43.5981	**51.9939**
	When ROOs are not satisfied	**57.7015**	34.4075
$\mu_b = 0.8$	When ROOs are satisfied	42.1161	**55.6894**
	When ROOs are not satisfied	**56.2741**	37.1215

* $a = 10$, $b = 0.5$, $C_a = 1$, $\beta_{bc} = 0.5$

<Table 6> Consumer surplus when ROOs are applied

Country	*Country A*	*Country B*

$\mu_b = 0.1$	When ROOs are satisfied (No tariff imposed on country B)	**36.2003**	**36.2003**
	When ROOs are not satisfied (Tariffs imposed on country B)	25.1112	**36.2003**
$\mu_b = 0.5$	When ROOs are satisfied	**37.0069**	**37.0069**
	When ROOs are not satisfied	25.5586	**37.0069**
$\mu_b = 0.8$	When ROOs are satisfied	37.6178	37.6178
	When ROOs are not satisfied	**25.8968**	**37.6178**

* $a = 10$, $\quad b = 0.5$, $\quad C_a = 1$, $\quad \beta_{bc} = 0.5$

<Table 7> Government surplus when ROOs are applied

Country		Country A	Country B
$\mu_b = 0.1$	When ROOs are satisfied (No tariff imposed on country B)	-	-
	When ROOs are not satisfied (Tariffs imposed on country B)	6.16741	-
$\mu_b = 0.5$	When ROOs are satisfied	-	-
	When ROOs are not satisfied	6.85185	-
$\mu_b = 0.8$	When ROOs are satisfied	-	-
	When ROOs are not satisfied	7.38074	-

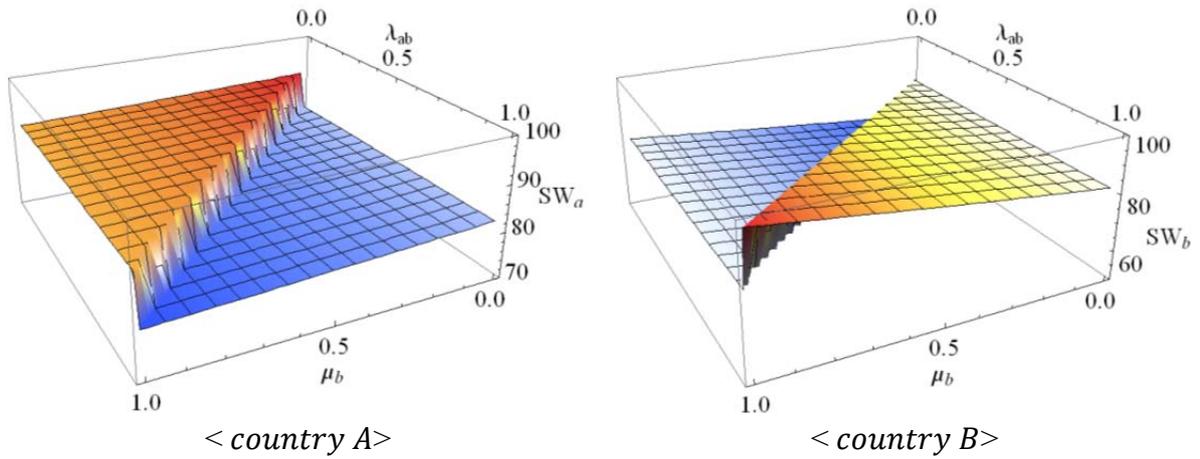* $a = 10$, $\quad b = 0.5$, $\quad C_a = 1$, $\quad \beta_{bc} = 0.5$

The impact of the varying levels of local requirements of ROOs on welfare is shown in <Figure 3>, demonstrating that the social welfare of country A drops sharply when the imports from country B satisfy the local contents requirement of country A. On the contrary, the social welfare of country B jumps up when the share of outsourced intermediate goods of firm B, μ_b, is low enough to satisfy the local contents requirement, λ_{ab}, satisfying ROOs of country A. The impact of varying λ_{ab}, the local contents requirement imposed by the country A to the imports from country B, on the producer surplus of countries A and B depends on the level of μ_b. When $1 - \mu_b < \lambda_{ab}$ with ROOs of country A not being satisfied, the non-cooperative tariffs of country A are imposed on the imports from country B. Therefore, the producer surplus of firm A is far higher than the case of $1 - \mu_b > \lambda_{ab}$, where ROOs of country A are satisfied and tariffs are not imposed. In the same context, when $1 - \mu_b \geq \lambda_{ab}$, the producer surplus of firm B is far higher than that in the case of $1 - \mu_b < \lambda_{ab}$.

However, the impact of the varying level of ROOs, λ_{ab}, on the consumer surplus of country *A* shows the opposite trend to the producer surplus of country *A*. When the products imported from country *B* satisfy ROOs of country *A*, i.e., $1 - \mu_b > \lambda_{ab}$, with no tariff imposed on the goods from country *B*, the consumer surplus of country *A* is far higher than the case of $1 - \mu_b < \lambda_{ab}$ since the domestic price of imports in country *A* is lower than the case where imported tariffs are imposed. Notwithstanding the negative impacts of strict ROOs of country *A* on its consumer surplus, the social welfare of country *A* is higher with the stricter ROOs imposing import tariffs on the goods from country *B*.
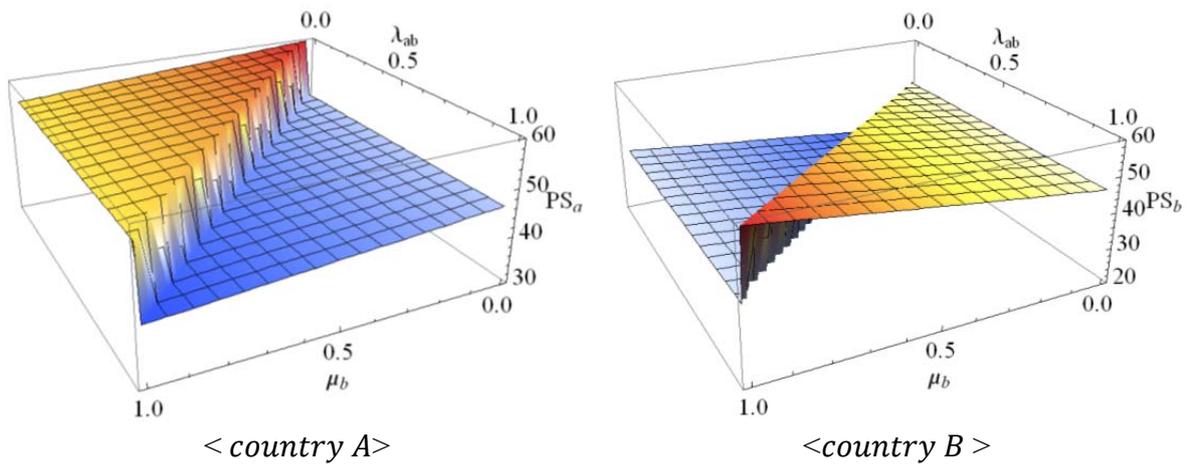
The rationale behind this result is that the positive impacts on the producer surplus with stricter imposition of ROOs by country *A* dominate the negative impact on its consumer surplus mainly because the strategic advantage provided to firm *A* by stricter ROOs dominates the welfare loss due to the higher price of the imports. This effect of ROOs is exactly equivalent to the strategic protective trade policies, and can therefore be interpreted in that context as strong evidence for the feature of ROOs as typical strategic protective trade policies. This effect of ROOs as a strategic protective trade policy drives country *A* to set the strictest local content requirements of ROOs while country *B* always complies to ROOs by limiting outsourcing to satisfy the local contents requirement. If firm *A* is allowed to outsource cheaper intermediate goods, ROOs play exactly the same role as the non-cooperative protective trade policies

Although stricter application of ROOs provides higher welfare than mild application of ROOs by providing strategic advantages to domestic firms, the higher ratio of outsourcing by firm *B*, μ_b, improves the social welfare of country *A* as well as the welfare of country *B*, as shown in <Figure 3> and <Table 3>. The intuition behind this result is that once the imposition of import tariffs is decided, the social welfare of country *A* increases with the higher ratio of outsourcing by firm *B* since the price of imports is decreased with more outsourcing.

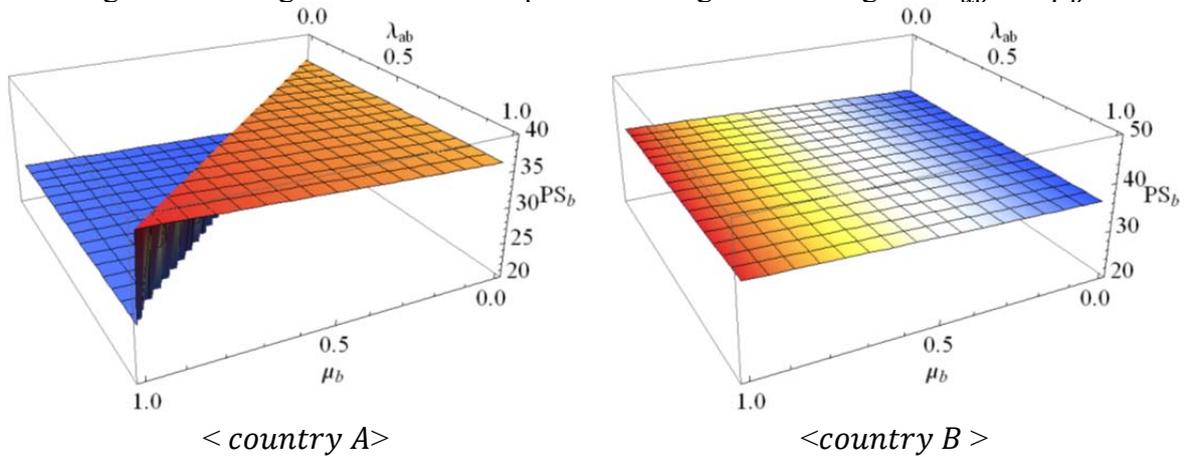<Figure 3> Change of social welfare according to the change of λ_{ab} and μ_b

< country A>   < country B>

<Figure 4> Change of producer surplus according to the change of λ_{ab} and μ_b

< country A>   <country B >

<Figure 5> Change of consumer surplus according to the change of λ_{ab} and μ_b

< country A>   <country B >

23

5. Concluding remarks

We examined the equilibrium free trade regime considering the impacts of ROOs on each country's incentive to join PTA. When we assume that only country *B* can outsource the cheaper intermediate goods from country *C*, the bilateral FTA between countries *A* and *B* is the unique equilibrium free trade regime when ROOs are not applied since country *C* has no incentive to join the PTA due to its technological monopoly power to produce the intermediate goods at cheaper costs. Even when ROOs are applied, the bilateral FTA between countries *A* and *B* is the unique equilibrium with firm *B* limiting the outsourcing of intermediate goods to satisfy the local content requirements. When the local content requirements are imposed by country *A*, firm *B* can maximize its profits by satisfying the local content requirement after joining the bilateral FTA between countries *A* and *B*.

Given the bilateral FTA between countries *A* and *B* as the unique equilibrium free trade regime, country *A*'s social welfare is maximized with the introduction of the strictest ROOs with the maximum local content requirement. When country *A* serves as a mechanism designer, the welfare of country *B* is maximized by satisfying the local content requirement. Although firm *B* can improve its producer surplus by outsourcing more intermediate goods from country *C* as long as the local content requirements imposed by country *A* are satisfied, firm *B* has no incentive to increase the outsourcing of intermediate goods to the level violating ROOs since the loss from tariffs being imposed dominates the cost reduction effect of outsourcing.

In addition, we found that ROOs are used as a strategic trade policy to support domestic firms competing with foreign firms that have technological advantages through exclusive access to outsourcing cheaper intermediate goods. If we extend our model allowing firm *A* the chance to access outsourcing cheaper intermediate goods as firm *B*, the equilibrium will be the case of typical prisoners' dilemma-type non-cooperative equilibrium. Therefore, it is a critical issue to arrange a coordinating mechanism to avoid the prisoners' dilemma-type outcome, which is observed in the majority of FTA negotiations as extensive negotiation efforts over ROOs issue.

Consequently, extensive efforts over negotiation on ROOs issues have been made in most FTA negotiations, including the latest examples of FTA negotiations pursued by the Korean, EU, and US governments.[10] All these findings suggest that ROOs are highly likely to be exploited as protective trade measures in arranging PTAs, and it is required to arrange an international coordination mechanism to avoid the prisoners' dilemma-type outcome due to the non-cooperative applications of ROOs by each member country of PTAs. In this context, further studies are required to examine how the efforts to arrange a cooperative approach on ROOs can produce a consistent result with the complementary market liberalization after preferential trade liberalization.

---

[10] The latest report on 'Preferential rules of origin in regional trade agreements' released by the WTO says that "preferential rules of origin in RTAs are increasingly becoming an economic, political and trade instrument" and suggests to "launch exploratory works on preferential rule of origin within an open regionalism scenario." Refer Maria Donner Abreu (2013), WTO Working Paper ERSD-2013-05.

References

Abreu, Maria Donner (2013), "Preferential rules of origin in regional trade agreements," WTO Staff Working Paper ERSD-2013-05.

Antras Pol. and Davin Chor, "Organizing the Global Value Chain", NBER Working Paper 18163, 2012

Becker, G. S, "A Theory of Competition among Pressure Groups for Political Influence" Quarterly Journal of Economics, Vol. 98, 1983, pp.371-400

Bhagwati, Jagdish; Greenway, David; Panagariya, Arvind. "Trading preferentially: theory and policy" The Economic Journal, Vol. 108(449), 1998, pp.1128-1148.

Cadot, O. and J. de Melo, A. Estevadeordal, A. Suwa-Eisenmann, and B. Tumurchudur. "Assessing the Effect of NAFTA's Rules of Origin." Mimeo. 2002.

Falvey, R. and G. Reed., "Economic Effects of Rules of Origin" Weltwirtshaftliches Archiv Vol. 134, 1998, pp.209-229.

John J. Barcelo Ⅲ, "Harmonizing Preferential Rules of Origin in the WTO System", Cornell Law School Legal Studies Research Paper Series, No. 06-049, Cornell Law School, 2006, pp.2-3

Ju, J. and K. Krishna., "Firm Behavior our and Market Access in a Free Trade Area with Rules of Origin" Canadian Journal of Economics Vol. 28, 2005, pp.290-308.

Krishna, K. and A. O. Krueger., "Implementing Free Trade Agreements: Rules of Origin and Hidden Protection" A. V. Deardoff and R. M. Stern eds. New Directions in Trade Theory, 1995, pp.149-187.

Krueger, A. O., "Free Trade Agreements as Protectionist Devices: Rules of Origin", Trade Theory and Econometrics: Essays in Honor of John S. Chipman, 1999, pp. 91-101.

Rosellon, P. L., "The Economics of Rules of Origin", Trade Theory and Econometrics: Essays in Honor of John S. Chipman, 1999,

Stigler, G., "The Theory of Economic Regulation" Bell Journal of Economics, Vol. 2(1), 1971, pp.359-365

USITC, "The Impact of Rules of Origin on U.S. Imports and Exports" USITC Publication, 1985