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 as a non-tariff trade barrier focusing on the strategic effects of rules of origin (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 bilateral FTA with technologically dominant supplier of intermediate goods staying out is a unique equilibrium trade regime. In addition, a country with no global outsourcing option prefers to introduce PTA with strictest type of rules of origin imposing the highest local contents requirement. When the country with no global outsourcing option commands market power in mechanism design for ROOs, the producer surplus of outsourcing firm can be maximized by satisfying the binding condition for the local contents requirements of ROOs. When both countries have accesses to outsourcing cheaper intermediate goods, ROOs play the role of non-cooperative strategic trade policies with the prisoners’ dilemma type outcome. These outcomes support the necessity to arrange an international coordination mechanism to avoid the prisoners’ dilemma type equilibrium due to strategic non-cooperative implementation of ROOs.

Keywords: Preferential Trade Agreements, 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

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1. Introduction

With the recent proliferation of preferential trade agreements (PTA), trade barriers have been significantly reduced at regional level. However, the rapid globalization of production networks with the global fragmentation of production process and extensive offshoring strategies, ‘rules of origin’ (ROOs) have emerged as a critical issue, while it is also criticized as a new version of trade barriers. ROOs become a critical issue especially when a preferential trade agreement is arranged 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 member countries of PTA. To prevent this type of side effects of PTA formation, ROOs require 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, rules of origin (ROOs) are applied in different ways for each country because there is no unified international rule, providing a large room for ROOs to be used as a non-tariff barrier since details of ROOs are unclear and intricate. Most preferential trade agreements use rules of origin 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 2) to reduce the uncertainty involved with rules of origin in international trade. The Harmonized Rules of Origin agreement, which took effect in 1995, is designed to provide a uniform criteria to determine the origin of all trading goods 3) 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.

Rules of origin take two formats in general i) ‘wholly obtained criterion’ and ii) ‘substantial transformation criterion’. ‘Wholly obtained criterion’ is applied mostly to agricultural and marine products, and assign the origin of a product to the country that

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2) Harmonized Rules of Origin agreement started in July 1995, and was remitted to WTO by WCO (World Customs Organization). WTO negotiates through CRO (Committee on Rules of Origin).
3) HS 6 unit standards, application of about 5,000 goods.
produces the product wholly in the country. ‘Substantial transformation criterion’ is applied mostly to industrial products, and assign the country of origin via ‘Tariff Shift Rules’5), ‘Value Added Rules’6) and ‘Specific Process Rules’7), that have been processed in more than two countries.

As there are divergent opinions about the economic effect of rules of origin, John & Barcelo (2006) argued that rules of origin have been abused with distortion, complexity, non-transparent and inconsistency in the implementation process. Krueger (1999) showed that ROOs have aggravated the trade diversion effects caused by PTA with the evidence that Mexican firms exporting to the U.S. should use more expensive U.S. intermediates in order to meet the rules of origin of the NAFTA. 8) Cadot et al. (2002) provided evidences that rules of origin of NAFTA have restricted the chances for market access to NAFTA markets.

Krishna and Krueger (1995), and Falvey and Reed (1998) showed that rules of origin have strictly increased production costs since ROOs have induced to use 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 rules of origin. However, Ju and Krishna (2005) have shown that overly strict rules of origin rather increase import of intermediate goods from non-member countries. Meanwhile, in an empirical study of rules of origin, USITC (1985), based on a survey on export and import firms, showed that rules of origin incur additional costs of $30,000 ~ $100,000 to trading firms.

This study aims to analyze the optimum strategies for preferential trade agreements considering the effects of rules of origin with global outsourcing strategies based on an oligopoly market where firms compete in Cournot fashion. We examine the case where there are three countries and two countries, $A$ and $B$, produce final products while a country $C$
produces only intermediate goods at cheaper price with a higher technology than country \( A \) and \( B \). 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 formation of PTA while introducing ROOs, we demonstrate that bilateral PTA excluding 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 strictest type of rules of origin imposing the highest local contents requirement. When the country with no global outsourcing option, country \( A \), commands market power in mechanism design for ROOs, the producer surplus of outsourcing firm in country \( B \), can be maximized by satisfying the binding condition for the local contents requirements of ROOs decided country \( A \). When both countries have access to outsourcing cheaper intermediate goods, ROOs play the role of non-cooperative strategic trade policies with the prisoners’ dilemma type outcome. These outcomes support the necessity to arrange 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, and section 3 examines the equilibrium preferential trade agreements 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 examined, too. Section 5 discusses the policy implications of 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. This is a 3-stage game, and the sequence of game is as follows. First, each government arranges the optimal preferential trade agreement (PTA) and decides the rules of origin with respect to the preferential tariffs applied to the PTA member countries. 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 firm of country A and B produces 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 $C_i$. The representative firm of country B can outsource intermediate goods from country C at the cost of $\beta_b C_b$, where $0 < \beta_b < 1$, in addition to the local production of the intermediate goods at the cost of $C_b$. The ratio of the outsourcing among the total provision of intermediate goods is denoted as $\mu_b$. Country C produces only intermediate goods depending on firm B’s decision on outsourcing strategies of the intermediate goods.

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

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

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

The aggregate demand ($Y_i$) that determines the price ($P_i$) is the sum of the quantity of domestic production ($y_i$) and quantity of import ($Y_{ji}$) from country $j$ to country $i$. $a$ and $b$ are parameters which denote market size and price elasticity of demand respectively, and they are assumed to be symmetric among countries. The production of each representative firm involves individual firms has a marginal cost ($C_i$)$^9$, and assumes that as the level of the

$^9$ 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 weighted production
global outsourcing of intermediate goods is increased, the marginal cost decreases\(^{10} \).  

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

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

\[
Country \ C : \Pi_c = (\beta_{bc}C_b - C_C)\mu_b(Y_{ba} + Y_{bc}) + (\beta_{bc}C_b - t_{bc})\mu_bY_b \tag{4}
\]

where \( t_{ji} \) is the import tariff that \( country \ j \) imposes on the import goods from \( country \ i \).

In equation (3), the first term on the right hand side is domestic firm’s profit in the domestic market, and the second term is 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 rules of origin which penalizes the outsourcing strategies among PTA member countries on the PTA formation strategies, 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.

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

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

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

\( 10 \) For country \( C \), the price \((\mu, \beta_j)\) of intermediate goods \((x)\) is determined by global sourcing strategies of country \( B \). If country \( B \) produces all intermediate goods by local production, \( \mu_b = 0 \), while if country \( B \) outsources all intermediate goods, \( \mu_b = 1 \).
From the above profit maximization problem, the equilibrium outputs are given as follows:

**Country A:** \( y^*_a = \frac{1}{3b} (a - 2C_a + (\beta_{bc} - 1)\mu_b C_b + t^*_{ab}) \) \hspace{1cm} (6)

\[ Y^*_a = \frac{1}{3b} (a - 2C_a + (\beta_{bc} - 1)\mu_b C_b - 2t^*_{ab}) \] \hspace{1cm} (7)

\[ Y^*_{ac} = \frac{1}{3b} (a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b - 2t^*_{ca} + t^*_{cb}) \] \hspace{1cm} (8)

**Country B:** \( y^*_b = \frac{1}{3b} (a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b + t^*_{ba}) \) \hspace{1cm} (9)

\[ Y^*_b = \frac{1}{3b} (a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b - 2t^*_{ba}) \] \hspace{1cm} (10)

\[ Y^*_{bc} = \frac{1}{3b} (a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b - 2t^*_{cb} + t^*_{ca}) \] \hspace{1cm} (11)

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, \( \frac{\partial y^*_i}{\partial t^*_{ji}} = -\frac{2}{3b} < 0 \). Moreover, exports are increased with the import tariffs imposed on third country’s products, \( \frac{\partial y^*_i}{\partial t^*_{jk}} = \frac{1}{3b} > 0 \).

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:

\[ W_i(t_{ij}) = a Y_i - \frac{b(Y_i)^2}{2} - P_i Y_i + \prod_i + \sum_{j=1}^{n} t_{ij} Y_{ji} \] \hspace{1cm} (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, while it 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 preferential trade agreements (PTAs). In this case, each country imposes non-cooperative Nash tariff tariffs to maximize her social welfare in a non-cooperative way.\textsuperscript{11} Optimal tariffs are derived from the social welfare maximization problems as follows:

\begin{equation}
    t_i^{MFN} = \arg \max W_i^{MFN}(t_i) 
\end{equation}

In MFN, the optimum tariff level of each country is as follows.

\textit{Country A}: 
\begin{equation}
    t_{ab}^{MFN} = \frac{1}{3}(a - C_b + \mu_b C_b - \beta_{bc} \mu_b C_b) 
\end{equation}

\textit{Country B}: 
\begin{equation}
    t_{ba}^{MFN} = \frac{1}{3}(a - C_a), \quad t_{ba}^{MFN} = 0
\end{equation}

\textit{Country C}: 
\begin{equation}
    t_{ca}^{MFN} = \frac{1}{11}(a - 5C_a + 4C_b - 4\mu_b C_b + 7\beta_{bc} \mu_b C_b + 7t_{cb}^*),
\end{equation}
\begin{equation}
    t_{cb}^{MFN} = \frac{1}{11}(a + 4C_a - 5C_b + 5\mu_b C_b - 11\beta_{bc} \mu_b C_b + 7t_{ca}^*)
\end{equation}

Reflecting the vertical value chains between country \textit{B} and \textit{C}, country \textit{B} imposes no tariff on the imports from country \textit{C} since intermediate goods are imported to reduce the production costs of the representative firm in country \textit{B}. When the above equilibrium tariffs

\textsuperscript{11} 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.
are substituted to the profit maximization problem of the representative firm in country A and B, the equilibrium outputs for the domestic market and exports for firm A and B are given as follows:

\[
\text{Country A: } y^*_a = \frac{1}{9b}(4a - 7C_a + 3C_b - (C_a - 3C_b)(\beta_{bc} - 1)\mu_b) \tag{17}
\]

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

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

\[
\text{Country B: } y^*_b = \frac{1}{9b}(4a + 2C_a - 6(C_b + (\beta_{bc} - 1)\mu_bC_b)) \tag{20}
\]

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

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

3. The impacts of rules of origin on the formation of preferential trade agreements and social welfare

There are a variety of international trade regimes possible with three countries. The first case is the non-cooperative trade regime where each country decides her tariffs in a non-cooperative way separately with no coalition. The second option would be the case of bilateral preferential trade agreement with one country remaining as an outsider. The third possibility is the case of hub & spoke type PTA where one country arranges bilateral 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 as a global free trade regime (GFT). The details of the possible trade regimes are as follows:
Non-Cooperative Trade regime – (1) : \{ A, B, C \}

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) \}, (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 rules of origin is 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 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 country A and B are symmetric, \( C_a = C_b = 1 \), while firm B outsources 50% of total intermediate goods from country C at the 50% of domestic production cost. As noted in <Table 1>, country 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 & C where country C stays out of FTA as an outsider country. The intuition behind that 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. The reason why country B imposes no tariffs on the intermediate goods from country C is
that firm C has a technology monopoly to produce the intermediate goods at the half cost of country B and C.

In addition, country A and B have incentives to join the global free trade regime while country C prefers the non-cooperative trade regime or bilateral FTA regime between country A and B, and therefore, the global free trade 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 her technology monopoly power in producing intermediate goods at the half production cost, while country C loses tariff revenues with no additional market access chances when she joins any free trade regime.

Table 1 shows the welfare levels of three countries in 8 trade regimes when ROO is applied assuming that firm B outsources 50% of intermediate goods from country C. According to ROO, when country A and B arrange a bilateral FTA, country A imposes tariffs on imported goods from country B while products of country A are imported to country B with no tariff imposed since firm B outsources 50% of intermediate goods.

<table>
<thead>
<tr>
<th>Case</th>
<th>Country A</th>
<th>Country B</th>
<th>Country C</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Non-cooperative trade regime</td>
<td>74.7786</td>
<td>80.4144</td>
<td>45.4826</td>
</tr>
<tr>
<td>(2) Bilateral FTA between A &amp; B</td>
<td>80.605</td>
<td>89.0009</td>
<td>46.0104</td>
</tr>
<tr>
<td>(3) Bilateral FTA between A &amp; C</td>
<td>85.4563</td>
<td>82.4325</td>
<td>42.0025</td>
</tr>
<tr>
<td>(4) Bilateral FTA between B &amp; C</td>
<td>76.5978</td>
<td>92.0864</td>
<td>42.0025</td>
</tr>
<tr>
<td>(5) Hub (A) &amp; Spoke type FTA</td>
<td>91.2827</td>
<td>91.0189</td>
<td>42.5303</td>
</tr>
<tr>
<td>(6) Hub (B) &amp; Spoke type FTA</td>
<td>82.4242</td>
<td>100.673</td>
<td>42.5303</td>
</tr>
<tr>
<td>(7) Hub (C) &amp; Spoke type FTA</td>
<td>82.2222</td>
<td>88.5872</td>
<td>41.2292</td>
</tr>
<tr>
<td>(8) Global free trade regime</td>
<td>88.0486</td>
<td>97.1736</td>
<td>41.7569</td>
</tr>
</tbody>
</table>

* $a = 10$, $b = 0.5$, $c_a = 1$, $\mu_b = 0.5$, $\beta_{bc} = 0.5$
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 country B and C have strong incentives to deviate to non-cooperative trade regime. Country B prefers the global free trade regime since ROO of preferential trade agreement does not work as a market entry barrier in the global free trade regime. However, the global free trade 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 she joins any free trade regime.

Therefore, when ROOs are applied and imported goods from country B does not satisfy the minimum local content requirement, there is no equilibrium free trade regime, and therefore, the non-cooperative trade regime, trade regime (1), 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 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 country 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 content requirements are not satisfied, there is no equilibrium free trade regime implying that too strict application of ROOs serves as a barrier against free trade regime.
<Table 2> Social welfare of trade regimes when rules of origin (ROO) are not satisfied

<table>
<thead>
<tr>
<th>Case</th>
<th>Country A</th>
<th>Country B</th>
<th>Country C</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Non-cooperative trade regime</td>
<td>74.7786</td>
<td>80.4144</td>
<td>45.4826</td>
</tr>
<tr>
<td>(2) Bilateral FTA between A &amp; B</td>
<td>90.112</td>
<td>71.4144</td>
<td>44.9826</td>
</tr>
<tr>
<td>(3) Bilateral FTA between A &amp; C</td>
<td>85.4563</td>
<td>82.4325</td>
<td>42.0025</td>
</tr>
<tr>
<td>(4) Bilateral FTA between B &amp; C</td>
<td>76.5978</td>
<td>92.0864</td>
<td>42.0025</td>
</tr>
<tr>
<td>(5) Hub (A) &amp; Spoke type FTA</td>
<td><strong>100.79</strong></td>
<td>73.4325</td>
<td>41.5025</td>
</tr>
<tr>
<td>(6) Hub (B) &amp; Spoke type FTA</td>
<td>91.9311</td>
<td>83.0864</td>
<td>41.5025</td>
</tr>
<tr>
<td>(7) Hub (C) &amp; Spoke type FTA</td>
<td>82.2222</td>
<td>88.5872</td>
<td>41.2292</td>
</tr>
<tr>
<td>(8) Global free trade regime</td>
<td>88.0486</td>
<td>97.1736</td>
<td>41.7569</td>
</tr>
</tbody>
</table>

*Note: a = 10, b = 0.5, c_A = 1, \mu_b = 0.5, \beta_{bc} = 0.5*

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

<table>
<thead>
<tr>
<th>Case</th>
<th>Country A</th>
<th>Country B</th>
<th>Country C</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Non-cooperative trade regime</td>
<td>74.8303</td>
<td>81.1417</td>
<td>44.9771</td>
</tr>
<tr>
<td>(2) Bilateral FTA between A &amp; B</td>
<td>80.4203</td>
<td>90.0528</td>
<td><strong>45.4038</strong></td>
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<tr>
<td>(3) Bilateral FTA between A &amp; C</td>
<td>85.5079</td>
<td>83.1597</td>
<td>41.497</td>
</tr>
<tr>
<td>(4) Bilateral FTA between B &amp; C</td>
<td>76.6929</td>
<td>93.1267</td>
<td>41.3361</td>
</tr>
<tr>
<td>(5) Hub (A) &amp; Spoke type FTA</td>
<td><strong>91.0979</strong></td>
<td>92.0708</td>
<td>41.9236</td>
</tr>
<tr>
<td>(6) Hub (B) &amp; Spoke type FTA</td>
<td>82.2829</td>
<td><strong>102.038</strong></td>
<td>41.7627</td>
</tr>
<tr>
<td>(7) Hub (C) &amp; Spoke type FTA</td>
<td>82.08</td>
<td>89.7389</td>
<td>40.6233</td>
</tr>
<tr>
<td>(8) Global free trade regime</td>
<td>87.67</td>
<td>98.65</td>
<td>41.05</td>
</tr>
</tbody>
</table>

*Note: a = 10, b = 0.5, c_A = 1, \mu_b = 0.4, \beta_{bc} = 0.5*

Now, we examine the impact of increasing level of outsourcing, \mu_b, on social welfare. When ROO is not applied, it is shown that as the level of outsourcing by firm B is increasing, the social welfare of country B is increasing 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 ROO is applied with the local contents requirement, \lambda_{AB}, being 50%, if \mu_b \in [0, \frac{1}{2}], the social welfare levels of three countries are the same as the case when ROO is
not applied. However, when the ratio of the outsourcing reaches 50%, country A imposes non-cooperative tariffs on imported goods 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 is jumping up 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 tariff imposed, while the increase in the producer surplus is dominant to the 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 $\mu_b \in \left[\frac{1}{2}, 1\right]$ with ROO applied, the social welfare of country B is increasing 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 is increasing with the deepening outsourcing, $\mu_b$, since the production cost of firm B is decreasing with the increasing $\mu_b$. At the same time, the social welfare of country C is increasing too 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. The positive impacts on consumer surplus of country A by increasing $\mu_b$ is counterbalanced with the negative impacts on the producer surplus of firm A due to the increased competitiveness of firm B. Therefore, the impact of increasing $\mu_b$ on the social welfare of country A is limited to the insignificant level, as shown in <Figure 1>.

<Figure 1> The impact of deepening outsourcing ($\mu_b$) on social welfare

< When ROO is not applied >

< When ROO is applied >
Now we examine the impact of the cost reduction effect of outsourcing on social welfare of member countries of FTA, country 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 $\beta_{bc}$. Therefore, as $\beta_{bc}$ increases, the cost reduction effect of outsourcing is dampened. As shown in <Figure 2>, when the rules of origin are not applied, the social welfare of country B is decreasing with the higher $\beta_{bc}$, i.e., the lower cost reduction effect of outsourcing, although the welfare level is still dominant to the welfare of country A. The impact of increasing $\beta_{bc}$ on the social welfare of country A is limited since the positive impacts on the producer surplus of country A is counterbalanced by the negative impacts on the consumer surplus of country A. When the rules of origin is applied, with the increasing $\beta_{bc}$, the social welfare of country B is decreasing while the welfare level of country A is dominant to 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 ($1/\beta_{bc}$) on social welfare

We examine the optimal rules of origin for country A and the optimal outsourcing strategy for firm B when country A and B arranges free trade agreement 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, ROOs of country B is 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, is lower than 1 − λ_{ji}, country A does not impose any tariff on goods from country B, while non-cooperative tariffs are imposed if 1 − μ > λ_{ab}. The profit function of firm B is defined as follows:

$$
\Pi_i = (P_i - (\beta_{ij}C_i + (1 - \mu_i)C_i))Y_i + (P_j - (\beta_{ij}C_i + (1 - \mu_i)C_i) - \tau_it_{ij}^*)Y_{ij} + (P_k - (\beta_{ij}C_i + (1 - \mu_i)C_i) - t_{kk}^*)Y_{ik}
$$

where \( \tau_i = 0 \) if \( 1 - \mu_i \geq \lambda_{ji} \) and \( \tau_i = 1 \) if \( 1 - \mu_i < \lambda_{ji} \).

As defined in equation (23), country A imposes non-cooperative tariffs only when firm B’s local provision of the intermediate goods, 1 − μ, is lower than the minimum level of local contents requirements, λ_{ab}, of country A’s rules of origin. For country A, \( \tau_i \) is always 0 since firm A does not outsource intermediate goods. The higher the ratio of outsourcing, \( \mu_i \), 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 − μ ≥ λ_{ab}, and therefore, country A does not impose any tariff on imports from country B.

< Equilibrium outputs when ROOs are satisfied (1 − μ ≥ λ_{ab}) >

**Country A:**

$$
y_{a}^* = \frac{1}{2b}(4a - 7C_a + 3C_b - (C_a - 3C_b)(\beta_{bc} - 1)\mu_b)
$$
When ROOs are not satisfied with the rate of domestic provision of intermediate goods are lower than the minimum rate of local contents requirement of ROO, country A imposes tariffs on imported goods from country B, and the equilibrium outputs are given as follows:

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

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

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

Country B : \[
y_b^* = \frac{1}{3b} \left( a + C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b \right) 
\]  
(27)

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

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

Country A : \[
y_a^* = \frac{1}{3b} \left( a - 2C_a + C_b + (\beta_{bc} - 1)\mu_b C_b \right) 
\]  
(30)

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

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

Country B : \[
y_b^* = \frac{1}{3b} \left( a + 2C_a - 2C_b - 2(\beta_{bc} - 1)\mu_b C_b \right) 
\]  
(33)

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

\[
Y_{bc}^* = \frac{1}{24b} \left( 6a + 10C_a - 16C_b + (-16(\beta_{bc} - 1)C_b + (16\beta_{bc} - 7)\mu_b C_a \right) 
\]  
(35)
The bilateral FTA between country $A$ 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 country $A$ and $B$, social welfare of country $A$ and $B$ are maximized when ROOs are satisfied with the whole range of outsourcing of firm $B$ as shown in <Table 3>. <Table 3> 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 country $B$ and $A$ are 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 $A$ herself as a protective trade policy.

The feature of ROOs as a protective trade policy is shown in a more explicit way in <Table 4> and <Table 5>. It is shown that the producer surplus is maximized when ROOs are most strictly applied with the minimum local contents requirements being higher than 90%, $\lambda_{ab} > 0.9$. In such a case, ROOs of country $A$ cannot be satisfied, and therefore, import tariffs will be imposed by country $A$ on the imported goods from country $B$ even if firm $B$’s share of outsourcing remains as low as 10%, $\mu_b = 0.1$. 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 minimum local contents requirement is higher than 90%. In terms of consumer surplus, the strict application of ROOs, that induces the 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 more strict application of ROOs, which induces lower level of firm $B$’s outsourcing or the imposition of import tariffs on firm $B$’s products, on country $A$’s welfare turns out to be positive. The rationale behind this result is that the positive impacts on the producer surplus by introducing more strict ROOs is dominant to 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 $A$. 

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<Table 4> Social welfare when ROOs are applied

<table>
<thead>
<tr>
<th>Country</th>
<th>Country A</th>
<th>Country B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_b = 0.1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied (No tariff imposed on country B)</td>
<td>81.8142</td>
<td>83.47</td>
</tr>
<tr>
<td>When ROOs are not satisfied (Tariffs imposed on country B)</td>
<td>90.9145</td>
<td>67.1577</td>
</tr>
<tr>
<td>$\mu_b = 0.5$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>80.605</td>
<td>89.0009</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>90.112</td>
<td>71.4144</td>
</tr>
<tr>
<td>$\mu_b = 0.8$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>79.7339</td>
<td>93.3072</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>89.5517</td>
<td>74.7393</td>
</tr>
</tbody>
</table>

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

<Table 5> Producer surplus when ROOs are applied

<table>
<thead>
<tr>
<th>Country</th>
<th>Country A</th>
<th>Country B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_b = 0.1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied (No tariff imposed on country B)</td>
<td>45.6139</td>
<td>47.2698</td>
</tr>
<tr>
<td>When ROOs are not satisfied (Tariffs imposed on country B)</td>
<td>59.6358</td>
<td>30.9574</td>
</tr>
<tr>
<td>$\mu_b = 0.5$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>43.5981</td>
<td>51.9939</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>57.7015</td>
<td>34.4075</td>
</tr>
<tr>
<td>$\mu_b = 0.8$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>42.1161</td>
<td>55.6894</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>56.2741</td>
<td>37.1215</td>
</tr>
</tbody>
</table>

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

<Table 6> Consumer surplus when ROOs are applied

<table>
<thead>
<tr>
<th>Country</th>
<th>Country A</th>
<th>Country B</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu_b = 0.1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied (No tariff imposed on country B)</td>
<td>36.2003</td>
<td>36.2003</td>
</tr>
<tr>
<td>When ROOs are not satisfied (Tariffs imposed on country B)</td>
<td>25.1112</td>
<td>36.2003</td>
</tr>
<tr>
<td>$\mu_b = 0.5$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>37.0069</td>
<td>37.0069</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>25.5586</td>
<td>37.0069</td>
</tr>
<tr>
<td>$\mu_b = 0.8$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ROOs are satisfied</td>
<td>37.6178</td>
<td>37.6178</td>
</tr>
<tr>
<td>When ROOs are not satisfied</td>
<td>25.8968</td>
<td>37.6178</td>
</tr>
</tbody>
</table>

* $a = 10$, $b = 0.5$, $C_a = 1$, $\beta_{bc} = 0.5$
The impact of the varying level of minimum local requirements of ROOs on welfare is shown in <Figure 3> demonstrating that social welfare of country $A$ drops sharply when the imported goods 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 $B$, $\mu_b$, is lower than the minimum level of local contents requirement, $\lambda_{ab}$, satisfying ROOs of country $A$. The rationale behind this result is provided by <Figure 4> and <Figure 5>. The impact of varying $\lambda_{ab}$, the minimum level of local contents requirement imposed by the country $A$ to the imported goods from country $B$, on the producer surplus of country $A$ and $B$ depends on the level of $\mu_b$. When $\mu_b > \lambda_{ab}$ with ROOs of country $A$ not satisfied, the non-cooperative tariffs of country $A$ is imposed on the imported goods from country $B$. Therefore, the producer surplus of firm $A$ is far higher than the case of $\mu_b < \lambda_{ab}$, where ROOs of country $A$ is satisfied and tariffs are not imposed, and the producer surplus jumps when $\mu_b = \lambda_{ab}$. In the same context, when $\mu_b < \lambda_{ab}$, the producer surplus of firm $B$ is far higher than the case of $\mu_b > \lambda_{ab}$.

However, the impact of varying level of ROOs, $\lambda_{ab}$, on consumer surplus of country $A$ shows an opposite feature than producer surplus of country $A$. When the products imported from country $B$ satisfy ROOs of country $A$, i.e., $\mu_b < \lambda_{ab}$, with no tariff imposed on the goods from country $B$, consumer surplus of country $A$ is far higher than the case of $\mu_b > \lambda_{ab}$ since the domestic price of imported goods in country $A$ is lower than the case where imported tariffs are imposed. Notwithstanding the negative impacts of strict ROOs of country $A$ on her 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 $A$ is dominant to the negative impact on her consumer surplus mainly due to the strategic advantage provided to firm $A$ by stricter ROOs is dominant to the welfare loss due to the higher price of the imported goods. The above feature of ROOs is in the exactly same line as the strategic protective trade policies, and in that context, can be interpreted as a strong evidence for the feature of ROOs as typical strategic protective trade policies. The feature of ROOs as a strategic protective trade policies drive country $A$ to set strictest local content requirements of ROOs while country $B$ always complying to ROOs by limiting outsourcing to the minimum level to satisfy the local contents requirement. If we allow firm $A$ the chances for outsourcing cheaper intermediate goods, ROOs play the exactly same role as the non-cooperative protective trade policies.

Although stricter application of ROOs, which eventually leads to impose import tariffs on the imported goods from competing countries, provides higher welfare than mild application of ROOs with no import tariff imposed, once the violation of ROOs is decided, the higher ratio of outsourcing by firm $B$, $\mu_b$, 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 $A$ is increasing with the higher ratio of outsourcing by firm $B$ since the price of imported goods gets lower with more outsourcing.
<Figure 3> Change of social welfare according to the change of \( \lambda_{ab} \) and \( \mu_b \)

<country A>  
<country B>

<Figure 4> Change of producer surplus according to the change of \( \lambda_{ab} \) and \( \mu_b \)

<country A>  
<country B>

<Figure 5> Change of consumer surplus according to the change of \( \lambda_{ab} \) and \( \mu_b \)

<country A>  
<country B>
5. Concluding remarks

Rules of origin (ROOs) are considered to be an essential part of the negotiation for preferential trade agreement to prevent the leakage of preferential market access chances to non-member countries of the PTA. The minimum local content requirements of ROOs drive the imported goods from PTA member countries to be imposed with tariffs if the local contents requirements are not satisfied with the share of outsourced intermediate goods being higher than the critical level. In such a way, ROOs prevent the non-member countries from benefiting the preferential market access chances designed only for member countries.

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

Given the bilateral FTA between country $A$ 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 with the minimum level of outsourcing. Although firm $B$ can improve her producer surplus with 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 is dominant to the cost reduction effect from 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 to outsourcing cheaper intermediate goods as firm $B$, the equilibrium will be the case of typical prisoners’ dilemma type non-cooperative equilibrium. Therefore, it is an urgent issue to find a coordinating mechanism to avoid the prisoners’ dilemma type outcome, which is observed in majority of FTA negotiations as extensive negotiation efforts over ROOs issue.

Therefore, it is an urgent issue to find a coordinating mechanism to avoid the prisoners’ dilemma type outcome, and 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 the US governments.\textsuperscript{12} All these findings suggests 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 countries 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 strategic complementary market liberalization after preferential trade liberalization.

\textsuperscript{12} The latest report on ‘Preferential rules of origin in regional trade agreements’ released by 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.
Reference


