

Trade Costs and Welfare-worsening Free Trade Agreement[†]

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Abstract

This study examines the effects of concluding an free trade agreement (FTA) in the presence of international trade costs between countries. We construct a simple three-country model of imperfect competition with endogenously determined (external) tariffs, and demonstrate that in the presence of trade costs, the optimal external tariffs set by the FTA members can be higher than the pre-FTA optimal tariffs, as compared to the tariff complementarity effect which is commonly obtained in the literature. The failure to achieve the tariff complementarity effect implies that the nonmember country becomes worse off after the FTA, but even in the presence of tariff complementarity effect, the nonmember country's welfare would be reduced if the trade costs between FTA member countries are high and the trade costs between member and nonmember countries are low. It is also shown that, depending on the trade costs and the substitutability between commodities, the conclusion of FTAs does not necessarily improve the member countries' welfare.

JEL classification F13, F15

Keywords Trade Costs, Free Trade Agreement, Tariff Complementarity Effect.

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1 Introduction

Regional trade agreements (RTAs) has been dramatically increased over the last two decades. Among the several forms of RTAs, most of the existing arrangements take the form of free trade areas (FTAs) as of 7 April 2015, while less than 10% are represented by customs unions (CUs).¹ There has also been a considerable number of studies that address issues related to RTAs.² Among others, it has been argued in the literature whether an RTA facilitates global free trade. A well-known result is a so-called *tariff complementarity effect* in the case of FTAs; members of an FTA would set external tariffs below the pre-FTA level (Bagwell and Staiger, 1999). An intuition behind this trade-liberalizing property of FTAs is that because an FTA leads its member countries to import less from non-member countries, the member countries have less incentive to manipulate their terms of trade vis-à-vis non-members, thus leading to lower external tariffs. There has been a number of studies that highlight the tariff complementarity effects in different settings including Richardson (1993), Yi (2000), Bond et al. (2004), Ornelas (2005), and Saggi and Yildiz (2010). However, in most of the theoretical studies it has been assumed that international trade is costless.

Trade costs, as a matter of fact, are considerably large. Anderson and van Wincoop (2004) estimate trade costs, broadly defined as all costs incurred in getting a good to a final user other than the marginal cost of producing the good itself, including transportation costs, policy barriers, information costs, contract enforcement costs, costs associated with the use of different currencies, legal and regulatory costs, and local distribution costs, for industrialized countries; a rough estimate of the ad-valorem tax equivalent of representative trade costs is 170 percent.³ In view of the fact that tariffs are now being at low levels, especially among developed countries, and the increasing RTAs facilitates the elimination or reduction of tariff barriers, trade costs can become a more significant factor as impediments to freer trade.

In this paper we explore how trade costs affect the desirability of FTA formation in a simple three-country model of imperfect competition. We follow Furusawa and Konishi (2005, 2007) to decompose the welfare effect

¹See the WTO website (https://www.wto.org/english/tratop_e/region_e/region_e.htm). Facchini et al. (2012) develop a political economy model of trade policy under imperfect competition to provide a positive explanation for the prevalence of FTAs rather than CUs.

²See e.g., Maggi (2014, §4) for a survey of recent developments.

³This ad-valorem tax equivalent include 55% local distribution costs as well as international trade costs, the latter break down into 21% transport costs and 44% border-related trade barriers ($1.7 = 1.55 \times 1.21 \times 1.44 - 1$).

of FTA formation. When consumers have quasi-linear utility function and all countries share the same constant returns production technology, social welfare of a country can be decomposed into consumers' gross utilities and trade surplus of non-numeraire goods (see also Furusawa and Konishi, 2004). In this case, therefore, the effect of signing an FTA on a country's welfare can be decomposed into the effect on consumers' gross utilities and trade surplus. In the presence of trade costs, some of economic surplus become pure waste, and thus there is an additional term in the welfare decomposition, which is namely the change in trade costs that a country incurs before and after the conclusion of FTA.

In the present model, tariffs are endogenously determined by the national governments which seek to maximize national welfare. We consider three scenarios; a tariff discrimination, a most favored nation (MFN) principle, and an FTA. The tariff discrimination regime may violate the principle of non-discrimination prescribed in the GATT/WTO rule, but we analyze this case in order to understand the basic mechanism under which trade costs affect a country's optimal tariffs. Comparing the MFN optimal tariff and the optimal external tariff determined by FTA member countries, we demonstrate that a formation of an FTA may increase the external tariffs set by the member countries; the tariff complementarity effect may not hold. This occurs when the trade costs between FTA member countries are high and the trade costs between member and nonmember countries are low.

In models of FTAs with endogenously determined external tariffs, many studies have demonstrated positive welfare consequences of FTAs. This is because, when comparing the equilibrium external tariffs under FTAs and Pareto-improving levels of external tariffs,⁴ these studies have shown that the tariff complementarity effect is large enough to make the equilibrium external tariffs below the Pareto-improving external tariffs (e.g., Bagwell and Staiger, 1999; Yi, 2000; Bond et al., 2004; Ornelas, 2005), and consequently, both members and nonmembers of FTAs becomes better off. However, in the present model with trade costs, the tariff complementarity effect may not occur, and this makes the nonmember country worse off. Even in the presence of tariff complementarity effect, the nonmember country's welfare would be reduced if the trade costs between FTA member countries are high

⁴The well-known Vanek–Ohyama–Kemp–Wan theorem (Vanek, 1965; Ohyama, 1972; Kemp and Wan, 1976) establishes that if two or more countries form a CU by fixing their net external trade vector through a common external tariff and eliminating internal trade barriers, the union as a whole and the rest of the world cannot be worse off than before. Ohyama (2002) and Panagariya and Krishna (2002) extend the Vanek–Ohyama–Kemp–Wan theorem to the case of FTAs; they show the existence of FTAs that lead to Pareto improvements in world welfare.

and the trade costs between member and nonmember countries are low.

In the analysis of welfare effects of an FTA on member countries, we first consider the case of symmetric countries in which all three countries share the same trade costs. We show that there is a threshold level of trade costs above which the member countries' welfare will be lower under FTA than under MFN. That is, the conclusion of FTAs does not necessarily improve the member countries' welfare even if trade costs are symmetric. We subsequently consider cases in which the countries face asymmetric trade costs and examine how the threshold level of trade costs is affected by the asymmetries.

2 The economy

2.1 Settings

We construct an intraindustry trade model following Furusawa and Konishi (2005, 2007).⁵ There are three symmetric countries (indexed by i, j, k) in the economy. Each country has two sectors, the agricultural sector and the manufacturing sector. Consumers in both countries have identical preferences for agricultural and manufacturing goods. We assume that each consumer supplies one unit of labor and thus, the population size μ in each country is equal to the labor endowment.

The agricultural sector operates under perfect competition and constant returns to scale using only labor. To produce one unit of the agricultural good, one unit of labor needs to be employed in this sector. Assuming that agricultural goods are numeraire, the price and wage rate are equal to one.

The firms in manufacturing sector produce horizontally differentiated goods that are imperfectly substitutable for each other. The production of manufacturing goods operates under imperfect competition. Each variety ω is produced by one manufacturing firm, which is negligibly small and does not influence the behavior of other firms in the sector. Formally, there is a continuum Ω of manufacturing firms in the economy. Note that the set Ω also represents the set of all varieties of manufacturing goods in the economy. Assuming no entry to this sector, we normalize the size of the set, $|\Omega| = 1$. In this study, the distribution of manufacturing firms is symmetric between countries, so that domestic consumers own one third of the total number of

⁵Furusawa and Konishi (2005, 2007) employ a network formulation game and analyze whether global free trade is stable among n countries with an intraindustry trade model. Unlike their study, we introduce trade costs and explore the properties of trade policy in the presence of trade costs.

firms in the economy. The set of firms located in country i is denoted by $\Omega_i \subset \Omega$, whose size is one third, $|\Omega_i| = 1/3$.

To purchase one unit of the manufacturing good from abroad, consumers have to pay the trade costs and in addition to the good's price and the tariff imposed by the government. We refer the trade costs incurred in getting a good from a producer in country i to a final user in country j as τ_{ij} , which is independent on the direction of transportation, i.e., $\tau_{ij} = \tau_{ji}$. The tariff rate imposed on imports from country j by government of country i is represented as t_{ij} . While the trade costs are exogenously given, the import tariff rate is determined by the government and its revenue is evenly distributed to consumers in each country.⁶ To simplify the analysis, agricultural goods are assumed to be shipped without trade costs.

2.1.1 Preference

All consumers in the economy are assumed to be identical. We formulate the preferences of consumers with a quadratic utility function as follows:

$$\begin{aligned} u(q(\omega), q_0; \omega \in \Omega) \\ = \int_{\Omega} q(\omega) d\omega - \frac{1-\gamma}{2} \int_{\Omega} q(\omega)^2 d\omega - \frac{\gamma}{2} \left(\int_{\Omega} q(\omega) d\omega \right)^2 + q_0, \end{aligned} \quad (1)$$

where $q(\omega)$ (q_0) is the amount of manufacturing (agricultural) goods consumption and γ denotes the degree of substitutability between manufacturing goods. A lower γ means that consumers recognize manufacturing goods as more differentiated. If $\gamma = 0$, manufacturing goods are perfectly different from one another. If $\gamma = 1$, every manufacturing good is recognized as identical.

From the utility maximization problem, we can deduce the demand functions for manufacturing goods as follows:

$$q(\omega) = \frac{1}{1-\gamma} [1 - \tilde{p}(\omega) - \gamma(1 - \tilde{P})] \quad (2)$$

where $\tilde{p}(\omega)$ represents the consumer price of manufacturing goods ω and $\tilde{P}$

⁶If we suppose the trade costs are compensation for transport services supplied by the private sector, which is perfectly competitive, transport services are inelastically delivered with marginal cost pricing. It is reasonable that the trade costs τ are exogenously given as constant marginal costs in the competitive transport sectors. Some studies introduce the mechanism that transport costs are determined endogenously and explore its effects on the economy (see, e.g., Takahashi, 2006; Mun and Nakagawa, 2010; Tsubuku, 2014).

is a price index defined by

$$\tilde{P} \equiv \int_{\Omega} \tilde{p}(\omega) d\omega \quad (3)$$

This price index represents the sum of the consumer's price and average price supplied in country r as there is one firm in the economy. If consumers import the manufacturing goods, the consumer prices $\tilde{p}(\omega)$ contain the trade costs and tariff as follows:

$$\tilde{p}(\omega) = \begin{cases} p_{ii}(\omega) & \text{if } \omega \in \Omega_i, \\ p_{ri}(\omega) + t_{ri} + \tau_{ri} & \text{if } \omega \in \Omega_r, \ r \neq i. \end{cases} \quad (4)$$

where $p_{rs}(\omega)$ denotes the price of manufacturing goods in country r , produced in country s ($r, s = i, j, k$) and Ω_r is the set of manufacturing firms located in country r .

2.1.2 Manufacturing sector

The manufacturing firm producing a variety of ω supplies to both the domestic and two foreign countries. Supposing no marginal costs for the production, the operating profit $\pi_i(\omega)$ of the firm located in country i is

$$\pi_i(\omega) = \sum_{r=i,j,k} \mu p_{ir}(\omega) q_{ir}(\omega) \quad (5)$$

where $q_{rs}(\omega)$ stands for the quantity of manufacturing goods supplied to country s , produced in country r ($r, s = i, j, k$) and Ω_r is the set of manufacturing firms located in country r . Given the price index P_r and other firms' behavior in the economy, each firm maximizes own profit by setting the price.⁷ According to the first-order conditions of the profit maximization problem, all the firms in country i set their own prices as follows:

$$p_{ii} = \frac{1}{2}[1 + \gamma(1 - P_i)], \quad (6)$$

$$p_{ir} = p_{rr} - \frac{t_{ir} + \tau_{ir}}{2}, \ r = j, k. \quad (7)$$

⁷This assumption that differentiated goods in the manufacturing sector are denoted by the continuum of manufacturing firms deduces the same equilibrium regardless of price or quantity competition, so that our model excludes strategic interaction among manufacturing firms.

Regardless of the variety of differentiated goods, manufacturing goods are symmetrically priced by firms. Thus, hereafter, we omit an expression of the variety of ω . The export price set by the firms is cheaper than the domestic price, but the consumer price including the trade costs and tariff $p_{ir} + t_{ir} + \tau_{ir}$ exceeds the domestic one, so that there is no arbitrage between countries. In addition, we find a half of the trade costs and tariff absorbed by manufacturing firms. From (6) and (7), the difference between the prices faced by domestic and foreign consumers is $(p_{ir} + t_{ir} + \tau_{ir}) - p_{ii} = (t_{ir} + \tau_{ir})/2$, which is smaller than the trade costs and tariff paid by consumers.

Substituting (6) and (7) into the definition of price index $\tilde{P}$, equilibrium prices are determined as follows:

$$p_{ii} = \frac{1}{2 - \gamma} \left[1 - \gamma + \frac{\gamma}{2} (\bar{t}_i + \bar{\tau}_i) \right], \quad (8)$$

$$p_{ir} = \frac{1}{2 - \gamma} \left[1 - \gamma + \frac{\gamma}{2} (\bar{t}_r + \bar{\tau}_r) \right] - \frac{t_{ir} + \tau_{ir}}{2}, \quad r = j, k. \quad (9)$$

where $\bar{t}_i, (\bar{\tau}_i)$ is defined by the sum of tariffs (trade costs) as

$$\bar{\tau}_i \equiv \frac{1}{3} \sum_{r=j,k} \tau_{ri}, \quad \bar{t}_i \equiv \frac{1}{3} \sum_{r=j,k} t_{ri}.$$

We can get the equilibrium quantities from the relationship, $p_{rs} = (1 - \gamma)q_{rs}$, which can be provided by the firm's first order condition.

2.2 Welfare decomposition

We now characterize welfare of each country which has the symmetric economic structure, consumer's preference, firm behavior, the sizes of population and manufacturing firms instead of the trade costs and tariffs faced by them. Due to the symmetric country, the welfare of country i out of the three countries is only shown. Per-capita income in country i is the sum of wage, which is equal to 1 in the present setting, rents of manufacturing production activities, and the distributed tax revenue:

$$y_r = 1 + \frac{1}{3} \frac{\pi_r}{\mu} + \frac{1}{3} \sum_{r=j,k} t_{ri} q_{ri}, \quad (10)$$

where the third term represents tariff revenue distributed by the government. Based on the budget constraint of consumer, the demand function for agricultural goods can be represented by the manufacturing demands as

follows:

$$\begin{aligned}
q_0 &= y_r - \frac{1}{3} \left[p_{ii}q_{ii} + \sum_{r=j,k} (p_{ri} + t_{ri} + \tau_{ri})q_{ri} \right] \\
&= 1 + \sum_{r=j,i} (p_{ri} + \tau_{ri})q_{ri} + \sum_{r=j,i} p_{ir}q_{ir}
\end{aligned} \tag{11}$$

Let us denote the vector of trade costs in country i and tariffs set by the government in that country by $\boldsymbol{\tau}_i = (\tau_{ji}, \tau_{ki})$ and $\mathbf{t}_i = (t_{ji}, t_{ki})$, respectively. Then, we can decompose the welfare in the equilibrium as follows:

$$\begin{aligned}
V_i(\mathbf{t}_i, \mathbf{t}_j, \mathbf{t}_k, \boldsymbol{\tau}_i, \boldsymbol{\tau}_j, \boldsymbol{\tau}_k) \\
= U_i(\mathbf{t}_i, \boldsymbol{\tau}_i) - IM_i(\mathbf{t}_i, \boldsymbol{\tau}_i) + EX_i(\mathbf{t}_j, \mathbf{t}_k, \boldsymbol{\tau}_j, \boldsymbol{\tau}_k),
\end{aligned} \tag{12}$$

where $U_i(\mathbf{t}_i, \boldsymbol{\tau}_i)$ refers to gross utility and $EX_i(\mathbf{t}_j, \mathbf{t}_k, \boldsymbol{\tau}_j, \boldsymbol{\tau}_k)$ ($IM_i(\mathbf{t}_i, \boldsymbol{\tau}_i)$) denotes the total value of exports (imports) of country i , which are respectively given by

$$U_i(\mathbf{t}_i, \boldsymbol{\tau}_i) \equiv \frac{1}{3} \sum_{r=i,j,k} q_{ir} - \frac{1-\gamma}{6} \left[\sum_{r=i,j,k} q_{ir}^2 \right] - \frac{\gamma}{18} \left[\sum_{r=i,j,k} q_{ir} \right]^2 + 1 \tag{13}$$

$$IM_i(\mathbf{t}_i, \boldsymbol{\tau}_i) \equiv \sum_{r \neq i} IM_{ri}(\mathbf{t}_i, \boldsymbol{\tau}_i) = \frac{1}{3} \sum_{r \neq i} (p_{ri} + \tau_{ri})q_{ri} \tag{14}$$

$$EX_i(\mathbf{t}_j, \mathbf{t}_k, \boldsymbol{\tau}_j, \boldsymbol{\tau}_k) \equiv \sum_{r \neq i} EX_{ri}(\mathbf{t}_r, \boldsymbol{\tau}_r) = \frac{1}{3} \sum_{r \neq i} p_{ir}q_{ir}. \tag{15}$$

In the above expressions, the productions and prices are evaluated at the equilibrium value which depends on trade costs and tariff, so that the difference in welfare level of each country is characterized by trade costs and tariff paid by consumers lived in that country.

It is worth referring the impacts of trade costs and tariff on (13), (14) and (15). First, consider the gross utility which is depend on the consumptions level of domestic production and the imports from two foreign countries. The effects of decrease in trade costs or tariff on the gross utility, $U_i(\mathbf{t}_i, \boldsymbol{\tau}_i)$ is ambiguous owing to substitution effect caused by the reduction. For example, high trade costs τ_{ji} raise the domestic and import demands from country k at the expense of imports produced in country j . Due to this substitution effects, it is not necessary that the gross utility is improved by trade cost reduction.

Second, we consider the response of import value $IM_i(\mathbf{t}_i, \boldsymbol{\tau}_i)$ to trade

costs and tariffs. For the similar reason in the case of gross utility, it is also obscure whether high tariff leads consumers decrease the payment for imports from abroad. An increase in tariff imposed on import from country j induces the consumers increase import value from country j , $IM_{ji}(\mathbf{t}_i, \boldsymbol{\tau}_i)$ while they also decrease imports from country k , $IM_{ki}(\mathbf{t}_i, \boldsymbol{\tau}_i)$. Furthermore, import value is defined as consisting of the payment for purchase imported goods as well as trade costs, and thus the change in trade costs has additional effects on import value. The high trade costs (per unit) lead less import value by import demands decreasing like an increase in tariff, whereas they increase the payment of trade costs driving import value increase.

Third, export value of country i is always lowered by high trade costs and tariff since export values supplied to each foreign country, $EX_{ji}(\mathbf{t}_j, \boldsymbol{\tau}_j)$ and $EX_{ri}(\mathbf{t}_k, \boldsymbol{\tau}_k)$, is independent each other regarding to trade costs and tariff.

3 Optimal tariff with trade costs

Here, we explore the relationship trade costs and optimal tariffs determined by government complying to three regimes; tariff discrimination regime, most favored nation (MFN) principle, and Free Trade Agreement (FTA). These optimal tariffs reduced in order to maximizing the national welfare depend on trade costs emerging between countries. In this section, the effect of trade costs on the optimal tariffs is investigated and it shown that the tariff complementarity effects does not appear under certain condition on trade costs.

3.1 Tariff discrimination regime

In order to make clear the incentive to set tariff, we analyze the tariff discrimination regime as benchmark case. In this subsection, each government can choose the tariff rate on each imports independently. It follows that the maximization problem for each government is,

$$\max_{t_{ji}, t_{ki}} V_i.$$

From, Eqs. (13), (14), and (15), the first order conditions can be written as

$$\frac{\partial U_i}{\partial t_{ri}} - \frac{\partial IM_{ki}}{\partial t_{ri}} - \frac{\partial IM_{ji}}{\partial t_{ri}} = 0, \quad r = j, k. \quad (16)$$

The first term in left side of Eq. (16) shows tariff effects on the gross utility of which the sign is ambiguous as mentioned above. The second and third terms are the effect on imports from two foreign country. We can identify the sign of second and third terms. Considering the effects of t_{ji} , $\partial IM_{ji}/\partial t_{ji}$ is negative and $\partial IM_{ki}/\partial t_{ji}$ is positive. From Eq. (16), we find that the tariff level imposed by the government does not depend on the tariff level imposed by the other government, so there is no strategic interdependence, as shown in Yi (1996). The discriminatory tariff imposed by country i on imports from country j is denoted as t_{ji}^D . Solving Eq. (16) for tariffs, we get the country i 's optimal discriminatory tariffs on each foreign country as follows:

$$t_{ji}^D = \frac{36(1-\gamma)(3-2\gamma) - (61\gamma^2 - 168\gamma + 108)\tau_{ji} + 4\gamma(3-2\gamma)\tau_{ki}}{159\gamma^2 - 468\gamma + 324}, \quad (17)$$

From Eq. (17), it is easy that to derive t_{ki}^D due to the assumption of symmetric country. The discriminatory tariffs are always positive as long as international trade is feasible. Comparing two discriminatory tariffs, it found that

$$t_{ji}^D > t_{ki}^D \Leftrightarrow \tau_{ji} < \tau_{ki}. \quad (18)$$

This result is summarized as following Proposition 1.

Proposition 1 (Tariff discrimination) *Each country under tariff discrimination regime imposes higher tariff on foreign goods imported with lower trade costs.*

Behind this result, we can provide the following intuition. Under the low trade costs occurring in the process to trade with country j , consumers in country i demand more imports from country j , which leads the government of country i impose the higher tariff on larger imports from country j . On the other hand, when the trade costs between country i and j is low, imports from country k is small due to substitution effects. In order to encourage the imports from country k , governments have an incentive to reduce the tariff imposed on that.

In addition, we find that the change in trade costs between certain two countries of three have two effects on tariff policy. For example, the reduction of trade costs between country i and j increase the imports from country j , and at the same time decrease the import demands from country k since the consumers substitute imports from country j for this. Under the tariff discriminatory regime, the governments can take the responses to

these effects independently and thus, the discriminatory tariffs, t_{ji}^D and t_{ki}^D , are oppositely affected each other by same trade costs.

3.2 Most favored nation principle

In this subsection, we explore the tariff determined complying MFN principle where each governments impose the same tariff on the other countries. The maximization problem of country i under MFN is defined as

$$\begin{aligned} \max_{t_{ji}, t_{ki}} \quad & V_i \\ \text{s.t.} \quad & t_{ji} = t_{ki} \end{aligned}$$

According to the first order condition of this problem, the MFN tariff satisfies the following condition.

$$\begin{aligned} \sum_{r=j,k} \left(\frac{\partial U_i}{\partial t_{ri}} - \frac{\partial IM_{ki}}{\partial t_{ri}} - \frac{\partial IM_{ji}}{\partial t_{ri}} \right) &= 0 \\ \Leftrightarrow \underbrace{\left(\frac{\partial U_i}{\partial t_{ji}} + \frac{\partial U_i}{\partial t_{ki}} \right)}_{\ominus: \text{ Loss of the utility}} - \underbrace{\left(\frac{\partial IM_{ji}}{\partial t_{ji}} + \frac{\partial IM_{ji}}{\partial t_{ki}} \right)}_{\oplus: \text{ The income gain}} - \underbrace{\left(\frac{\partial IM_{ki}}{\partial t_{ki}} + \frac{\partial IM_{ki}}{\partial t_{ji}} \right)}_{\oplus: \text{ The income gain}} &= 0. \quad (19) \end{aligned}$$

This condition, Eq. (19), reveals that when the government increase t_{ji} and t_{ki} simultaneously, its net benefit should be equal to zero and consist of three parts; the loss of utility as decrease in consumption, two income gains caused by decrease in import payments to foreign countries. The MFN tariff rate imposed by country i is obtained as follow:

$$t_i^{MFN} = \frac{24(1-\gamma)(3-2\gamma) - (23\gamma^2 - 60\gamma + 36)(\tau_{ji} + \tau_{ki})}{106\gamma^2 - 312\gamma + 216}. \quad (20)$$

Based on the assumption that international trade is feasible, the MFN tariff rate can be shown to be positive. Eq. (20) shows that what matters is the sum of trade costs, $\tau_{ji} + \tau_{ki}$, not each level of trade costs since three countries are symmetric. As compared with the discrimination regime, the liner demand functions yields the MFN tariff lying at middle point between two discriminatory tariffs as shown in Saggi (2009).

Consider the impacts of trade costs on the MFN tariff. The MFN tariff depending on only sum of trade costs, each trade costs shifting is indifference against the MFN tariff. However its effect is ambiguous and characterized

by the degree of substitutability γ as

$$\frac{dt_i^{MFN}}{d\tau_{ri}} \geq 0 \Leftrightarrow \gamma \geq \frac{6}{23}(5 - \sqrt{2}) \approx 0.935,$$

and thus we obtain Proposition 2.

Proposition 2 (Most favored nation tariff) *When the substitutability between domestic and foreign products is sufficiently high, then trade costs reduction foster the elimination of tariff barrier.*

The intuition behind Proposition 2 is that large γ amplifies the marginal benefits to imposing tariff which is the domestic income gains induced by substituting imports for domestic products, so that the MFN tariff increases as trade costs rising. Setting the single tariff rate on two countries under the MFN principle, each government is required to take into account the effects on both tariffs t_{ji} and t_{ki} together. Trade costs τ_{ji} increasing have the negative (positive) effects on imports from country j (country k), which provides the incentive to reduce (raise) the tariff on imports from country j (country k). Such conflicting incentives yielded by change in trade costs remain the effects of trade costs on the MFN tariffs unclear.

3.3 Free trade agreement

Supposing that country i and j enforce the free trade agreement where they impose the zero tariff rate on each other, we investigate the external tariff imposed by them on the non-member country (country k).⁸ The FTA member governments eliminate the tariff barrier within the member countries and set the external tariff on non-member country in order to maximize the own national welfare under the constraint that the external tariff is not more than the MFN tariff as follow:

$$\begin{aligned} \max_{t_{ki}} \quad & V_i \\ \text{s.t.} \quad & t_{ji} = t_{ij} = 0 \\ & t_{ki} \leq t_i^{MFN} \end{aligned}$$

Firstly, we consider the case of inner solution that the equality condition holds strictly, i.e., $t_{ki} < t_i^{MFN}$. If the optimal external tariff set by the mem-

⁸The maximization problem of the non-member country is equivalent to the case of tariff discrimination regime or MFN principle due to the independence of government's policy strategy.

ber is lower than the MFN tariff, the first order condition can be represented by

$$\left. \frac{\partial U_i}{\partial t_{ki}} \right|_{t_{ji}=t_{ij}=0} - \left. \frac{\partial IM_{ki}}{\partial t_{ki}} \right|_{t_{ji}=t_{ij}=0} - \left. \frac{\partial IM_{ji}}{\partial t_{ki}} \right|_{t_{ji}=t_{ij}=0} = 0. \quad (21)$$

In contrast to the MFN principle, the FTA member governments can choose the external tariff t_{ki} independently since the tariffs between the member countries, t_{ij} and t_{ji} is zero. In this case, the external tariff determined by the member governments is written by

$$t_{ki}^{FTA} = \frac{12(1-\gamma)(3-2\gamma) + (12-7\gamma)\gamma\tau_{ji} - 4(3-2\gamma)^2\tau_{ki}}{4(3-2\gamma)(9-5\gamma)}. \quad (22)$$

This tariff is also positive under the feasibility of international trade. From Eq.(22), we can show the effects of trade costs on the external tariff, $dt_{ki}^{FTA}/d\tau_{ki} < 0$ and $dt_{ki}^{FTA}/d\tau_{ji} > 0$ which is summarized in Proposition as follow:

Proposition 3 (External tariff in FTA) *The external tariff is increased by the higher trade costs between the FTA member countries as well as the lower trade costs between the member and non-member countries.*

Recalling the case of discriminatory tariff is useful to understand the effects of trade costs on the external tariff under FTA. The high trade costs τ_{ji} yield the more trade between the member and non-member due to the substitution effects, leading the incentive of the member country to protect the domestic manufacturing firms from the competition with the firms in non-member country. Therefore under high τ_{ji} , the member governments increase the external tariff in order to avoid the competition with firms in non-member country and increase the domestic firms' profit. In another intuition of this result, the imports from the member country is lowered as trade costs τ_{ji} increasing and thus, the FTA member governments increase the external tariff in order to foster the import demands from the member country at expense of non-member country. On the other hands, we can provide the similar intuitions regarding to the trade cost between the member and non-member countries. The lower trade costs, τ_{ki} , induce the government under FTA imposes the higher external tariff due to intense competition with the firms in non-member country.

The case mentioned above is that under the FTA, the member has no incentive to set the higher tariff than the MFN tariff. If the optimal external tariff lies at higher level than the MFN tariff, then the inequality condition holds with equality, i.e., $t_{ki} = t_i^{MFN}$. It founds that the FTA conclusion does

not affect the tariff rate imposed by the members. This requires the trade costs to meet the following condition,

$$\frac{\partial U_i}{\partial t_{ki}} \Big|_{\substack{t_{ji}=t_{ij}=0, \\ t_{ki}=t_i^{MFN}}} - \frac{\partial IM_{ki}}{\partial t_{ki}} \Big|_{\substack{t_{ji}=t_{ij}=0, \\ t_{ki}=t_i^{MFN}}} - \frac{\partial IM_{ji}}{\partial t_{ki}} \Big|_{\substack{t_{ji}=t_{ij}=0, \\ t_{ki}=t_i^{MFN}}} > 0.$$

$$\Leftrightarrow \tau_{ji} > \tilde{\tau}_i(\tau_{ki}) \quad (23)$$

where $\tilde{\tau}_i$ is the upper bound of τ_{ji} achieving the equilibrium that the member, country i , imposes the lower tariff than under the MFN principle. If the trade costs between members exceed this thresholds $\tilde{\tau}_i$, then the members keep the external tariff rate at the same level with MFN tariff. This implies that tariff complementarity effects doesn't occur when condition Eq. (23) is satisfied. In the absence of trade costs, the external tariff is always declined by FTA formation relative to under the MFN principle of the GATT/WTO rule. Thus, what international trade is not costless leads the FTA formation to provides the incentive to raise the external tariff. From the equilibrium quantities, the requirement for trade costs supposing the feasibility of international trade can be represented as

$$\min\{q_{ji}^{MFN}(\tau_i), q_{ji}^{FTA}(\tau_i)\} \geq 0 \Leftrightarrow \tau_{ji} \leq \bar{\tau}_{ji}(\tau_{ki}), \quad (24)$$

$$\min\{q_{ki}^{MFN}(\tau_i), q_{ki}^{FTA}(\tau_i)\} \geq 0 \Leftrightarrow \tau_{ki} \leq \bar{\tau}_{ki}(\tau_{ji}), \quad (25)$$

Based on Eqs.(23), (24) and (25), we can illustrate the figure 1 regarding to the tariff complementarity effects when international trade is feasible. Figure 1 shows the two cases of each member, country i and j in the first and second quadrant respectively.⁹ The dotted lines stand for the upper bounds that the international trades are feasible, $\bar{\tau}_{ji}$ and $\bar{\tau}_{ki}$.

In the shaded area in Figure 1, the condition Eqs.(23), (24) and (25) are satisfied and thus the tariff complementarity effect doesn't appear in each country.

Proposition 4 (No tariff complementarity effects) *Under the larger trade costs between the FTA member countries and the smaller trade costs between the member and non-member countries, the optimal external tariffs of the FTA members cannot be lower than the MFN tariffs.*

Proposition 4 shows the possibility of tariff complementarity effects not rising once we focus on the economy with trade costs occurring in international trade. Under the MFN principle, the governments face the constraint

⁹Each threshold for country j is developed in the same way as country i .

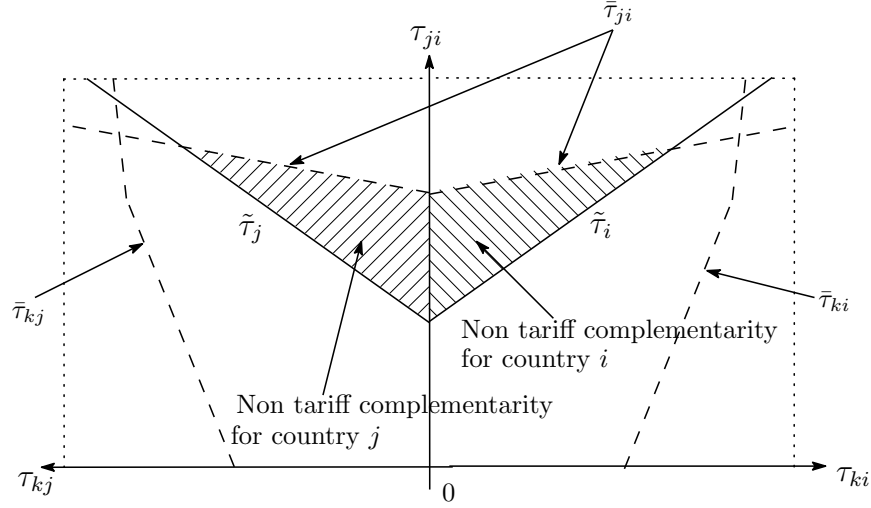


Figure 1: Trade costs and tariff complementarity effects

of setting the same tariff on the two countries and cannot adjust tariffs, t_{ji} and t_{ki} , to trade costs shifting independently. In contrast, the governments concluding FTA choose the external tariff without the such constraint, and thus they can employ the tariff policy corresponding to each trade costs independently. The large τ_{ji} and low τ_{ki} induce the higher external tariff since the member government have an incentive to protect domestic firms against more importers from non-member country. And it becomes to hold Eq. (23), then the members are not able to raise the external tariff and set it at the same level with MFN tariff. In that case, there is not tariff complementarity effect.

4 Welfare analysis

At first glance, the formation of FTA improve the all countries' welfare because international trade is fostered as tariff barrier eliminated by each government. However, provided the fact that trade costs occur in the process of international trade, the FTA formation is likely to worsen the welfare of member countries under the certain condition. In this section, we explore the effects of FTA conclusion on the welfare in the presence of trade costs. Once we focus on the economy where the trade costs exist, the perfect market integration cannot be achieved by the FTA conclusion in our model in contrast to the previous literatures. Without loss of generality, we analyze the case that country i and j agree to set tariff on each other zero ($t_{ji} = t_{ij} = 0$). To

conserve space, let $\mathbf{t}^{FTA}$ ($\mathbf{t}^{MFN}$) represent the tariff schedules set by each government in the FTA (MFN) regime, i.e., $\mathbf{t}^{FTA} = (\mathbf{t}_i^{FTA}, \mathbf{t}_j^{FTA}, \mathbf{t}_k^{MFN})$ and $\mathbf{t}^{MFN} = (\mathbf{t}_i^{MFN}, \mathbf{t}_j^{MFN}, \mathbf{t}_k^{MFN})$. As discussed above, these tariff rates depend on the trade costs, so that the welfare impact of FTA conclusion is also influenced through the tariff change caused by trade costs.

4.1 Non-member

Here, we consider the welfare of non-member country affected by the FTA conclusion. In our setting, there is no strategic relationship between governments when they determine the tariff rate. Accordingly, country k (non-member country) remains the tariff rates in MFN principle even if country i and j form the FTA and eliminate the tariff on each other. Thus, the FTA formation affects the non-member's welfare only through the change in tariff rate set by the member countries. Actually, the non-member's welfare effects induced by the FTA can be denoted as follows:

$$\begin{aligned} \Delta V_k(\tau_i, \tau_j, \tau_k) &\equiv V_k(\mathbf{t}^{FTA}, \tau_i, \tau_j, \tau_k) - V_k(\mathbf{t}^{MFN}, \tau_i, \tau_j, \tau_k) \\ &= EX_k(\mathbf{t}_i^{FTA}, \mathbf{t}_j^{FTA}, \tau_i, \tau_j) - EX_k(\mathbf{t}_i^{MFN}, \mathbf{t}_j^{MFN}, \tau_i, \tau_j). \end{aligned} \quad (26)$$

where ΔV_k is the difference between the FTA welfare and MFN welfare of country k , which is consist of exports values in each state. Eq. (26) shows that a change in tariff schedules of the members matters for non-member country's welfare since the non-member does not change the tariff policy as a response to the FTA formation. In the other words, if the exports to country i and j are expanded as they are concluding the FTA, the non-member's welfare is sufficiently improved. As Eq. (26), the welfare effects are dependent on the tariff schedule of member countries, so that it is closely related to the tariff complementarity effects. If the tariff complementarity effects disappears when the non-member trade with both members, then the non-member's welfare always perishes due to decreases in the export to both members from the non-member.

Supposing the two trade costs faced by the non-member, τ_{ki} and τ_{kj} , are same level, we can illustrate Figure 2 based on Figure 1. This figure represents the combination of trade costs inducing the tariff substitution effects and worsening the non-member country's welfare. The range denoting the welfare worsening is larger than the range of non tariff complementarity. This is because even if the tariff complementarity effects appear and the firms in non-member country face the lower external tariff, it is not necessary that the exports from non-member country increases. As FTA formed, consumers

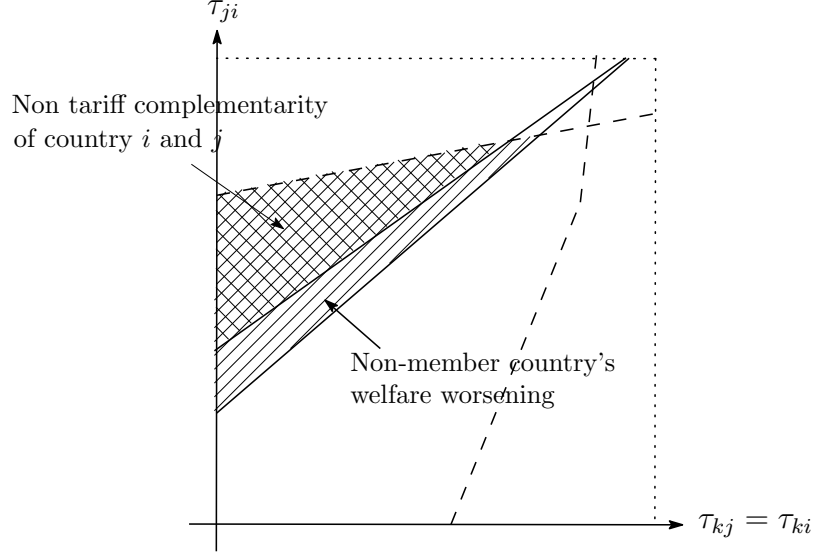


Figure 2: Welfare effects on non-member country

in both member countries substitute the imports from each other for that from non-member, so that the non-member's exports could decrease even under the tariff complementarity effects.

4.2 FTA members

In this subsection, we explore the welfare effects on the member countries induced by FTA formation. A difference of the FTA and MFN welfare for member country (country i) is

$$\begin{aligned} \Delta V_i(\tau_i, \tau_j, \tau_k) &\equiv V_i(\mathbf{t}^{FTA}, \tau_i, \tau_j, \tau_k) - V_i(\mathbf{t}^{MFN}, \tau_i, \tau_j, \tau_k) \\ &= \Delta U_i(\tau_i) + \Delta NE_{ij}(\tau_i, \tau_j) \\ &\quad - \Delta IM_{ki}(\tau_i) - \frac{\tau_{ji}}{3} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)]. \end{aligned} \quad (27)$$

where ΔU_i and ΔIM_{ki} are the difference between gross utilities and the values of imports from country k in each regime and defined as

$$\Delta U_i(\tau_i) \equiv U_i(\mathbf{t}_i^{FTA}, \tau_i) - U_i(\mathbf{t}_i^{MFN}, \tau_i), \quad (28)$$

$$\Delta IM_{ki}(\tau_i) \equiv IM_{ki}(\mathbf{t}_i^{FTA}, \tau_i) - IM_{ki}(\mathbf{t}_i^{MFN}, \tau_i). \quad (29)$$

Moreover, the welfare effects of member countries depend on the change in trade surplus between them and it is represented by $\Delta NE_{ij}(\tau_i, \tau_j)$, which is

$$\Delta NE_i(\tau_i, \tau_j) \equiv \frac{1}{3} \left\{ [p_{ij}^{FTA}(\tau_j)q_{ij}^{FTA}(\tau_j) - p_{ji}^{FTA}(\tau_i)q_{ji}^{FTA}(\tau_i)] - [p_{ij}^{MFN}(\tau_j)q_{ij}^{MFN}(\tau_j) - p_{ji}^{MFN}(\tau_i)q_{ji}^{MFN}(\tau_i)] \right\}. \quad (30)$$

Furusawa and Konishi (2005, 2007) also demonstrate that the welfare effects by the FTA conclusion can be divided into the gross utility effects (ΔU_i), direct surplus effect (ΔNE_i), and third country effects (ΔIM_{ki}) like Eq. (27). However, supposing that it takes costs to trade with foreign countries, we should consider another effects caused by FTA conclusion, trade cost effect ($\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3$). This effect could be negative for the country to conclude FTA. Forming the FTA between country i and j , As an increase in imports from county j , the amount of consumers' payment for importing goods increases and induce the loss of FTA formation.

4.2.1 Symmetric case

In this subsection, we show that even in the absence of asymmetry in trade costs, the FTA conclusion is likely to worsen the member countries' welfare. We assume that the trade costs between any tow countries are symmetric, $\tau_{ji} = \tau_{ki} = \tau_{kj} = \tau$.¹⁰ As shown in Figure 1, there are tariff complementarity effects under symmetric trade costs. The external tariffs faced by non-member country are always lowered by the both member country, so that the welfare of non-member country is improved as FTA conclusion.

Consider a condition for the feasibility of international trade in the present case. Under the assumption of symmetric trade costs, there are always tariff complementarity effects from Figure 1, so that the volume of international trade between any two of three countries is smaller under the MFN principle than the FTA. Considering the trade volume is same level for any country under the MFN, the condition for the feasibility of international trade is reduced as

$$q_{ji}(\mathbf{t}_i^{MFN}, \tau) \geq 0 \Leftrightarrow \tau \leq \frac{36 - 69\gamma + 33\gamma^2}{(6 - 5\gamma)^2} \equiv \bar{\tau}. \quad (31)$$

The welfare under the MFN principle is supposed to be $V_r(\mathbf{t}^{MFN}, \tau)$ for

¹⁰The symmetric trade costs induce the same tariff rate regardless of the tariff discrimination regime or MFN principle since all countries perfectly have symmetric structure including trade costs faced.

$\forall r$ in which three vectors of trade costs are summarized to one since each trade costs vector is symmetric. The MFN principle with symmetric trade costs urges all countries to set same tariff rate, $t_i^{MFN} = t_j^{MFN} = t_k^{MFN}$, so that each country get the same level of welfare. On the other hand, when country i and j conclude the FTA, the member countries (country i and j) and non-member country (country k) offers the different tariff schedule. We obtain the welfare of member countries, $V_r(\mathbf{t}^{FTA}, \boldsymbol{\tau})$ for $r = i, j$. Under the symmetric trade costs, the direct trade surplus effects disappear since $\boldsymbol{\tau}_j = \boldsymbol{\tau}_i$, so that the member's welfare effects induced by the FTA conclusion can be represented as follows:

$$\begin{aligned}\Delta V_i(\boldsymbol{\tau}) &\equiv V_i(\mathbf{t}^{FTA}, \boldsymbol{\tau}) - V_i(\mathbf{t}^{MFN}, \boldsymbol{\tau}) \\ &= \Delta U_i(\boldsymbol{\tau}) - \Delta IM_{ki}(\boldsymbol{\tau}) - \frac{\tau}{3} [q_{ji}^{FTA}(\boldsymbol{\tau}) - q_{ji}^{MFN}(\boldsymbol{\tau})] \quad (32)\end{aligned}$$

The tariff elimination between member countries and the tariff complementarity induce country i to do more trading with both partner and non-member. Hence the gross utility effects ΔU_i are positive on the welfare for members while the third country effects ΔIM_{ki} are negative. From comparison of Eqs. (28) and (29), we can show that the gross utility increase more than import value from non-member country as the FTA forming, $\Delta U_i - \Delta IM_{ki} > 0$, which lead the FTA improving the country i 's welfare. However, the third term in Eq. (32), trade cost effects $(\tau_{ji} [q_{ji}^{FTA}(\boldsymbol{\tau}_i) - q_{ji}^{MFN}(\boldsymbol{\tau}_i)] / 3)$, work as the FTA conclusion decrease the welfare of country i . It follows that the welfare of member country can be undermined when the third term is enough large to dominate the positive effects. The threshold of trade costs that the FTA improves the member's welfare can be reduced as

$$\Delta V_i(\boldsymbol{\tau}) \geq 0 \Leftrightarrow \tau \leq \hat{\tau} \quad (33)$$

We can show such $\hat{\tau}$ is smaller than $\bar{\tau}$ as depicted in Figure 3 and obtain this result:

Proposition 5 (Welfare-worsening free trade agreement) *Under the higher symmetric trade costs between countries, the conclusion of free trade agreement worsens the welfare of member countries.*

Proposition 5 indicates that the higher trade costs leads the FTA formed to undermine its member countries' welfare although the non-member country's welfare increases. An intuition behind Proposition 5 is as stated below. The tariff reduction by the conclusion of FTA fosters its members trading

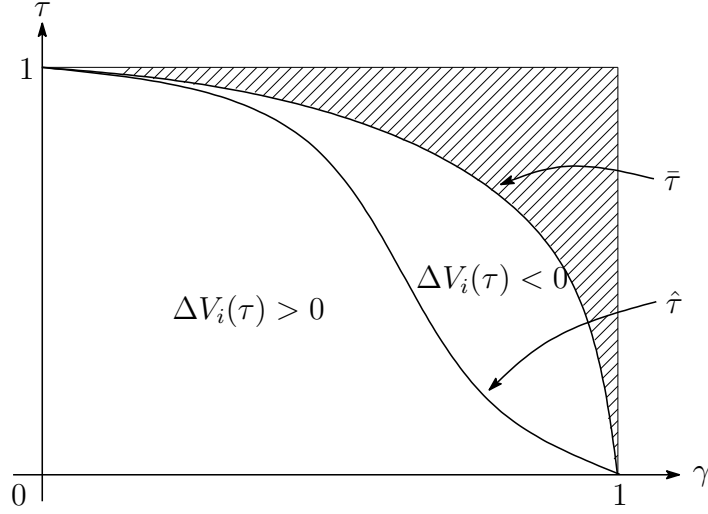


Figure 3: Trade costs and the FTA formation

with each other as well as non-member country. Although the expansion of international trade under the FTA improves the welfare of member countries, it also generates the loss of their welfare in the economy in which trade costs exist. The payment of trade costs by each member country, is more expensive under the FTA than the MFN principle. Such the payment is loss for the firms' rent and make the welfare reducing. Therefore if higher trade costs per unit τ create the larger loss in the process of trade between member countries, then the welfare loss induced from trade costs exceeds that gains induced by trade expansions.

4.2.2 Asymmetric cases

Here, we relax the assumption that each trade costs are symmetric. To identify an effects of the asymmetric structure on the FTA, we investigate the effects of small change in same trade costs on the FTA benefits relative to the symmetric equilibrium. Particularly, considering the threshold representing the equivalence between the FTA and MFN welfare, $\hat{\tau}$ in Eq. (33), its response to the asymmetric small change in trade costs is investigated. Such analysis enable us to understand the situation that the FTA have more beneficial effect for the member country with the respect to trade costs. Assuming that each trade costs is set as $\tau_{ij} = \tau + e_m$, $\tau_{jk} = \tau + e_j$ and $\tau_{ki} = \tau + e_i$, the threshold under the asymmetry is implicitly defined as

follows:

$$\Delta V_i(\tau_i, \tau_j, \tau_k) \geq 0 \Leftrightarrow \tau \leq \hat{\tau}_{asy}(e_m, e_i, e_j) \quad (34)$$

where if the trade costs are symmetric, $e_m = e_i = e_j = 0$, then $\hat{\tau}_{asy}$ is equal to $\hat{\tau}$ shown in Eq. (33). Considering the three cases about the trade costs; (i) $e_m = e$, $e_i = -e$ and $e_j = 0$, (ii) $e_m = e$, $e_i = 0$ and $e_j = -e$ and, (iii) $e_m = 0$, $e_i = e$ and $e_j = -e$, we investigate the effects of small change in e on the benefit to form the FTA for the member (country i) in each case.

(i) $e_m = e$, $e_i = -e$ and $e_j = 0$.

We focus on the change in costs faced by country i for trading with member country e_m and non-member country e_i . From Eq. (27), it found that

$$\left. \frac{d\hat{\tau}_{asy}(e, -e, 0)}{de} \right|_{e=0} < 0. \quad (35)$$

This implies that a decrease in e induces the $\hat{\tau}_{asy}$ increases and thus, the range in which the FTA improves the member's welfare, expands as the trade costs shifting asymmetrically. Therefore the benefit to conclude the FTA is amplified as the trade costs reducing within members and, increasing between own and non-member country. The trade cost effect in Eq. (27) induced by the FTA formation plays the important role in this case.

When the trade costs between country i and j reduce and those between country i and k increase such as shown in Eq. (35), the imports from member country increase and those from non-member decrease. And its effects is larger under the MFN principle than the FTA since the reduction of e in this case induces the external tariff to decrease in order to increase the imports from non-member country while the MFN tariff is constant. Provided these shifts of trade structure for country i , we consider the effects of trade costs on the benefit of the FTA. Such changes increase the payment of trade costs under the MFN relative to the FTA, which leads to improve the benefit of FTA formation. Thus, the threshold $\hat{\tau}_{asy}$ increases as the trade costs reducing between members and increasing between own and the non-member countries.

However, there are some channels not improving the benefits. The third country effects (ΔIM_{ki}) change as discouraging from concluding the FTA since the member country reduce the external tariff and thus, the payment to non-member country under the FTA is more expensive than under the MFN. Furthermore, the gross utility effects (ΔU_i) and the direct trade surplus effects (ΔNE_i) is ambiguous on the benefit of FTA and depend on the

degree of substitutability between the manufacturing goods. The decrease in e tends to shrink the gross utility effect (ΔU_i) and expand the direct trade surplus effects (ΔNE_i) since the substitute effects increasing the imports from partner country is moderated under the small γ . Despite such negative effects on the FTA benefits, the trade cost effects which influence positively on the FTA dominate the other negative effects under the environment of demand linearity and quasi-linear utility.

(ii) $e_m = e$, $e_i = 0$ and $e_j = -e$.

Consider the case of change in costs faced by members, country i and j , for their trading with non-member country. We obtain the following equation in the similar way to the previous case.

$$\left. \frac{d\hat{\tau}_{asy}(e, 0, -e)}{de} \right|_{e=0} < 0. \quad (36)$$

Eq. (36) shows that reduction in trade costs between members (country i and j) and increase in it between the partner and non-member country (country j and k) induce the threshold, $\hat{\tau}_{asy}$, to shift upward. This means such trade cost change represented by e amplifies the benefit to concluding the FTA between country i and j .

In contrast to case (i), the trade costs between own (country i) and non-member (country k) are constant, so that the tariff rate set by country i is influenced only by the trade costs between members. Thus, the external tariff on non-member country is induced to decrease by the reduction in e , but it is ambiguous on the MFN tariff. Such change in tariff rates affects on the country i 's imports from both countries. The reduction in external tariff brings imports from the non-member to increase, and thus an increment of the imports under the FTA is larger as compared with the situation under MFN principle. This is because the tariff imposed by country i on country k is have greater response to change in e under the FTA than the MFN, i.e., $dt_{ki}^{FTA}/de < dt_i^{MFN}/de < 0$. On the other hand, the imports from partner country is leaded to decrease by the trade costs reduction between them in both regime. Due to the ambiguity of the trade cost effects on the MFN tariff, it is not clear in which regime the imports from partner country decrease more than the other.

Given such shift in trade structure caused by the trade costs between members and tariff set by country i , it found that Eq. (36) is not explained only by the trade cost effects ($\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3$). When the trade costs τ are sufficiently large, the expenditure for trade costs increases with reducing the trade costs between members. However, we can

understand this case by considering the gross utility effect (ΔU_i) and trade cost effect ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$) simultaneously. Actually, under the high trade costs τ , the gross utility effects (ΔU_i) work as improving the FTA benefit for country i and exceed the negative trade cost effects ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$). On the other hand, the low trade costs τ indicate the trade cost effects ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$) enhancing the FTA benefit. Although the gross utility effect (ΔU_i) could decline as the trade cost between members decreasing due to the substitution effects, the positive trade cost effects are superior to negative that. These effects, the gross utility effect (ΔU_i) and trade cost effect ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$), create the positive effects on the FTA benefits when trade costs between members reduct and that between the partner and non-member increase slightly from the symmetric equilibrium.

Also, in this case, there is the effects declining the FTA benefits. Due to the higher tariff on non-member country employed in the FTA than the MFN, country i have the larger imports the non-member when the FTA is formed. Hence, the third country effect ($\Delta IM_{ki}(\tau_i)$) in this case shift negatively as an increase in the payment to non-member country. Additionally, country i 's trade structure is affected by the change in trade costs between the partner and non-member country. An increase in that trade costs induces the partner country to substitute the imports from non-member country for those from country i , which the export from country i to country j is expanded. Thus, the direct trade surplus effects ($\Delta NE_{ij}(\tau_i, \tau_j)$) are likely to work as strengthening the benefit of country i to from the FTA with country j . However, as mentioned above, the country i 's payments of imports from country j (the partner for country i) also could increase as the trade costs between members reducing. Such conflicting two direction effects about the trade between members make it ambiguous whether the direct trade surplus effects ($\Delta NE_{ij}(\tau_i, \tau_j)$) encourage to form the FTA. However, supposing the demand linearity and quasi-linear utility, these effects that could be negative are dominated by positive ones, the gross utility effect (ΔU_i) and trade cost effect ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$).

(iii) $e_m = 0$, $e_i = e$ and $e_j = -e$.

Here, we consider the effects of the costs faced by the two members when they trade with non-members respectively. However, it is not clear whether the FTA benefit improves as the change in e unlike the other two cases. In this case, the trade costs between members remain constant, so that the trade cost effects ($(\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3)$) are influenced indirectly from the trade costs between the non-member country. Thus, the influence

from it is mitigated relative to the previous two cases, resulting in the effect of trade cost reduction on the FTA benefit remaining unclear.

As the reduction of costs for trading with country k , the external tariff imposed by country i on country k (non-member country) increases while the effects on the MFN tariff is obscured. The decrease in trade costs between country i and k enhances their trading and, in contrast to this, country i could employ the higher tariff in both regimes as so to prevent that and save the payment to the non-member. The change of the external tariff is enough large to dominates the MFN tariff's change, but both tariff changes are not as large as the trade cost reduction. This indicates that country i according to the MFN increases the imports from country k more than under the FTA formation. On the other hand, the trade structure between members is affected from two aspects; the change in the trade costs between country i and k , and that between country j and k . When the imports from non-member country (country k) is increased as the reduction in trade costs between country i and k , this leads the consumers in country i to substitute the imports from country k for those from country j in the both regime. Also, the consumers in country j are induced by an increase in trade costs between country j and k to substitute the imports from country k for those from country i which bring about the increase in exports of manufacturing firms in country i .

From the changes of trade structure caused by the trade cost reduction between country i and k , we explain the effects on FTA benefit in the respects of gross utility effects (ΔU_i), third country effects ($\Delta IM_{ki}(\tau_i)$), and trade cost effects ($\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3$). As the trade cost reduction between country i and k , the gross utility effects (ΔU_i) have negative effects on the FTA benefits since country i under the MFN can achieve the unbiased consumption relative to the FTA. Considering the third market effects, an increase in the country i 's import value from country k caused by the trade cost reduction between them, is larger when the MFN is accorded than the FTA is formed between country i and j . Thus, in this case, the third country effects ($\Delta IM_{ki}(\tau_i)$) work as enhancing the FTA. Next, we consider the trade cost effect ($\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3$). The large substitution effects under the MFN lead country i to save the payment for trade costs more than when country i forms the FTA with country j . Consequently, a reduction in trade costs generating the substitution effects increases the payments of trade cost under the FTA relative to the MFN and thus does not improve the FTA benefit in this case.

In order to show the intuition about the direct trade surplus effects ($\Delta NE_{ij}(\tau_i, \tau_j)$), we need to focus on the effects on trade structure between members yielded by the trade costs faced by each member countries

via trading with non-member country. Based on the shift of trade structure as mentioned above, a reduction in e gives the country i 's trade surplus with country j the two effects which are opposed each others. Hence, it is obscure whether or not the direct trade surplus effects ($\Delta NE_{ij}(\tau_i, \tau_j)$) work on the FTA benefit as the change in trade cost denoted by e in this case.

In the previous two cases, the FTA benefits are improved as the reduction in trade costs even if there are ambiguous or negative effects. However, the change in e on the FTA benefits have ambiguous effects in this case focusing the each trade costs faced by the members when they trade with non-member country. This results from not affecting the trade costs between the member countries. Remaining the trade costs between the members constant, the trade cost effect ($\tau_{ji} [q_{ji}^{FTA}(\tau_i) - q_{ji}^{MFN}(\tau_i)] / 3$) is only affected by the substitution effects indirectly and it works as mitigate the benefit to forming FTA relative to the case of reducing the trade costs between the members.

5 Conclusion

To be written.

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