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Barriers to Global Free Trade through Bilateral Agreements

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Abstract

This paper examines the formation of bilateral free trade agreements (FTAs) in the context of a dynamic noncooperative bargaining game with a random proposer. We show that global free trade (a grand coalition) does not necessarily occur unless transfer payments among countries are allowed. When transfer payments are possible, bilateral FTAs always achieve global free trade, but the ex ante and ex post inequalities of social welfare among countries are larger than those when all countries are independent because of the strategic bargaining behavior.

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1 Introduction

Free trade agreements (FTAs) have become widespread. For example, the United States had enacted FTAs with 17 countries by 2010. The number of FTAs is growing rapidly in almost every region of the world, and many are bilateral agreements between two governments. The reason why bilateral FTAs tend to be adopted more often than custom unions is that FTAs are not required to harmonize policies among asymmetric insiders. Countries can set tariffs for outsiders independently and can reach a further bilateral agreement with an outsider without the consent of other members.

FTAs are becoming more common, but there is an important question of whether FTAs are building blocs or stumbling blocs to multilateral trade liberalization. This paper develops a dynamic non-cooperative game model to consider whether the sequential bilateral coalition can lead to global free trade. We show that global free trade (the grand coalition) is not necessarily formed if transfer payments among countries are not allowed, even though global free trade is efficient. Therefore, bilateral FTAs could be stumbling blocks against global free trade. Moreover, we examine the inequality among countries. We show that when transfer payments are possible, the grand coalition is always formed, but the ex-ante and ex-post inequality among countries is expanded through the strategic bargaining behavior.

There are several studies of the dynamic noncooperative bargaining models of trading bloc formation. In contrast to other models in the network formation literature[1], the dynamic noncooperative bargaining model (Aghion

[1]Goyal and Joshi (2006) and Furusawa and Konishi (2007) study the formation of FTAs in the context of a network formation game and show that a complete FTA network is pairwise stable if the countries are symmetric. Furusawa and Konishi (2005) and Bloch and Jackson (2007) analyze network formation when transfers between members are allowed.

et al., 2007, Macho-Stadler and Xue, 2007 and Seidman, 2009) analyzes the dynamic process of negotiations. At each period a single country or a two-country trading bloc is selected as a proposer and offers to form a trading bloc. The trading bloc is formed if all respondents agree. Aghion et al. assume that the leading country always becomes the proposer and makes take-it -or-leave-it offers. Macho-Stadler and Xue assume that the proposer is selected in a given order (i, j, k) and the surplus generated by a trading block is shared equally among its members. In contrast to the assumption of fixed division of returns, Seidman shows that equilibrium transfers endogenously. We also show that the sharing rule is determined endogenously through the bargaining.

Aghion et al. (2007), Macho-Stadler and Xue (2007) and Seidman (2009) show that the grand coalition is always formed and countries engage in global free trade, although this may be reached either directly or via a subset of countries. In their model, subcoalitions only form on the equilibrium path to the grand coalition. In contrast to their model, in which the proposer can decide on bilateral or multilateral bargaining, ours restricts the bilateral bargaining, and we show that a subcoalition can be an equilibrium outcome if there are positive externalities.

Mukunoki and Tachi (2006) also study the dynamic effects of bilateral FTAs in an oligopoly model. They showed that sequential expansion of bilateral FTAs leads to global free trade regardless of the discount factor. However, in their model countries are symmetric and the external tariffs are exogenously fixed in their model. International transfers between countries are assumed to be impossible. In contrast, we assume that FTA members optimally adjust their individual external tariffs and analyze the strategic behavior between asymmetric countries and transfers are allowed.

We adopt the three-country model of Macho-Stadler and Xue (2007). The formation of trading blocks is modeled as an infinite-horizon dynamic game. Each period consists of two stages. In the first stage, which is the coalition formation stage, the proposer makes an offer to form an FTA. If the FTA is formed, tariffs between members are eliminated. In the second stage, each country sets external tariffs and firms produce the output in the three markets. In contrast to Macho-Stadler and Xue7s study, the proposer is randomly chosen in each period, as in Okada (2000) [2]and the sharing rule is endogenously determined in the present paper. We consider three asymmetric countries and examines their strategic behaviors.

The rest of the paper is organized as follows. In Section 2, we describe the model and explain the bargaining procedure. In Section 3, each country sets the tariffs on an outsider to maximize its own welfare. In this case, the outsider enjoys positive externalities. We show that global free trade may not be an equilibrium outcome. In Section 4, we suppose the tariffs on the outsider are chosen to maximize the joint welfare of member countries. In this case, negative externalities are imposed on the outsider. We show that inequalities among countries are expanded through bargaining, while global free trade is achieved. Section 5 concludes the paper.

2 The Model

Consider a repeated bargaining game model with three countries, in each of which a single homogeneous good is produced and consumed in each period. Each country has one firm, which produces the good and sells it in the

[2]In contrast, the selection of proposer is history -dependent in Seidman's (2009) model. If a country rejects an offer in period $t-1$, then it is selected as the proposer in period t.

domestic and foreign markets. The inverse demand function of country $i = 1, 2, 3$, is

$$P_i = a_i - Q_i, \tag{1}$$

where P_i is the domestic price and Q_i is the total quantity which is sold in country i. We denote the quantity produced by firm j (a firm in country j) for market i (a market in country i) as q_{ij}. Therefore, $Q_i = q_{i1} + q_{i2} + q_{i3}$ for each country $i = 1, 2, 3$.

Country i imposes the specific tariff $\tau_{ij} \geq 0$ on imports from country j. We assume the quantity tax on the domestic firm is zero, i.e.,$\tau_{ii} = 0$. Each firm has a constant cost of production that is normalized to zero. Given the specific tariffs τ_{ij}, $i, j = 1, 2, 3$, each firm j sets the quantities for each Cournot market, (q_{1j}, q_{2j}, q_{3j}), to maximize profit in each period.

In a Cournot-Nash equilibrium for each period, the equilibrium quantity produced by firm j in market i is

$$\hat{q}_{ij} = \frac{a_i + (\tau_{i1} + \tau_{i2} + \tau_{i3})}{4} - \tau_{ij}, \tag{2}$$

and the total quantity in the equilibrium is

$$\hat{Q}_i = \frac{3a_i - (\tau_{i1} + \tau_{i2} + \tau_{i3})}{4}.$$

Then, the equilibrium profit for firm j is given by

$$\hat{\pi}_j = (\hat{q}_{1j})^2 + (\hat{q}_{2j})^2 + (\hat{q}_{3j})^2,$$

and the equilibrium consumer surplus in country i for each period is $CS_i = (\hat{Q}_i)^2/2$. The social welfare per period in country i is the sum of its consumer surplus, profit of the domestic firm, and tariff revenue. Given tariffs τ_{ij} for each country, country i's social welfare is

$$\begin{aligned} &W_i(\tau_{12}, \tau_{13}, \tau_{21}, \tau_{23}, \tau_{31}, \tau_{32}) \\ &\quad = (\hat{Q}_i)^2/2 + (\hat{q}_{ii})^2 + (\hat{q}_{ji})^2 + (\hat{q}_{ki})^2 + (\tau_{ij}\hat{q}_{ij} + \tau_{ik}\hat{q}_{ik}) \end{aligned} \tag{3}$$

where $i, j, k \in \{1, 2, 3\}$ are distinct numbers. In the initial state, each country i chooses its tariffs τ_{ij}, τ_{ik} independently to maximize its social welfare in each period. The initial (optimal) tariff for country i is given by

$$\tau_{ij}^I = \tau_{ik}^I = \frac{3}{10} a_i, \tag{4}$$

and the social welfare in the initial state is

$$W_i^I = \left[\frac{2}{5} (a_i)^2 + \frac{1}{100} (a_j)^2 + \frac{1}{100} (a_k)^2 \right]. \tag{5}$$

We consider a sequential bargaining process of bilateral FTAs starting from the initial state. If two countries reach an FTA, tariffs between them are zero. Negotiations about the FTA may occur in any period, and the consumption, production, and trade in each period are conducted under a given tariff structure. Each period is divided into two rounds: the FTA round and the trading round. Formally, at period t,

The FTA round:

(i) One country i ($i = 1, 2,$ or 3) is randomly selected as a proposer among all countries with positive tariffs.

(ii) Country i either selects country j as a partner in FTAs or chooses to remain in the status quo. If country i chooses the status quo, the game proceeds to the trading round.

(iii) Country j accepts or rejects the FTA proposal. If country j accepts it, tariffs between them are eliminated. If j rejects it, the game proceeds to the trading round.

The trading round:

(i) Each country adjusts its tariffs against countries without FTAs.

(ii) Given the above tariffs, the representative firm in each country produces the good under a Cournot market and consumers in each country obtain the good. The tariff revenue for each country is determined.

Assume that all countries have the same discount factor $\delta \in [0, 1)$. Each country negotiates their FTAs to maximize the discounted sum of social welfare. In the trading round, all players (countries, firms, and consumers of goods) are assumed to choose their actions (tariffs, productions, and demands) to maximize the per period payoff (social welfare, profit, and consumer surplus). Our solution concept for this game is a *stationary subgame perfect equilibrium* (SSPE), in which the proposal by each country in the FTA round at every period depends only on the current state of FTAs and the response of each country depends only on the current state of FTAs and the current proposal.

3 Partial Trading Bloc

3.1 FTAs without transfers: Positive externalities

We show an example in which only an FTA between two countries is reached and global free trade cannot be realized. Suppose that countries are heterogeneous in terms of their market size. The market size is represented by a_i $(i = 1, 2, 3)$ in the demand function (1). The economy consists of two small countries and one large country; $a_1 = a_2 = \underline{a}$, and $a_3 > \underline{a}$.

(Pareto efficiency) We consider a situation in which global free trade is desirable. In other words, an economy with all zero tariffs Pareto-dominates the initial state. The social welfare of country i in the global free trade is represented by

$$W_i^F = \left[\frac{11}{32}(a_i)^2 + \frac{1}{16}(a_j)^2 + \frac{1}{16}(a_k)^2\right], \quad i, j, k = 1, 2, 3.$$

Because $a_1 = a_2 = \underline{a}$ and $\underline{a} < a_3$, the social welfares of two small countries, 1 and 2, are always improved through the change from the initial state to the

global free trade ($W_1^F > W_1^I$ and $W_2^F > W_2^I$). If

$$(a_3)^2 < \frac{28}{15}(\underline{a})^2, \tag{6}$$

we have $W_3^F > W_3^I$. Therefore, when the difference between a_3 and $\underline{a}$ is not very large, global free trade is desirable for country 3. We assume condition (6) is satisfied in this section.

We denote the FTA between country i and j as FTA$[ij]$. FTA$[ij][ik]$ represents a hub-and-spoke pattern where country i is the hub.

(The initial state $\rightarrow$ FTA$[ij]$) Let us consider a situation in which an FTA between counties 1 and 2 is realized in period t. In this case, $\tau_{12} = \tau_{21} = 0$, and country 1 and 2 adjusts their tariffs against country 3 to maximize the social welfare independently. As a result, $\tau_{13} = a_1/7$ and $\tau_{23} = a_2/7$. Note that $a_i/7 < 3a_i/10$. Therefore, the optimal external tariffs are lower than the initial level.

Because markets are segmented, country 3 still imposes tariffs of $\tau_{31} = \tau_{32} = 3a_3/10$. Under these tariffs, the social welfare for each country is represented by

$$\begin{aligned}
W_1^{[12]} &= \left[\frac{5}{14}(a_1)^2 + \frac{4}{49}(a_2)^2 + \frac{1}{100}(a_3)^2\right], \\
W_2^{[12]} &= \left[\frac{5}{14}(a_2)^2 + \frac{4}{49}(a_1)^2 + \frac{1}{100}(a_3)^2\right], \\
W_3^{[12]} &= \left[\frac{2}{5}(a_3)^2 + \frac{1}{49}(a_1)^2 + \frac{1}{49}(a_2)^2\right].
\end{aligned}$$

Because the FTA induces members to reduce external tariffs considerably, the outside country 3 is better off, compared with the initial state[3]; $W_3^{[12]} > W_3^I$.

[3]Yi (2000), Bond et al. (2004), and Ornelas (2005) show that the optimal external tariff of the FTA members is sufficiently reduced and welfare of nonmembers is increased in their respective models.

Thus, FTAs have positive externalities for outside countries. Moreover, if $a_1 = a_2$, social welfare for countries 1 and 2 is improved by an FTA between 1 and 2; $W_1^{[12]} > W_1^I$ and $W_2^{[12]} > W_2^I$.

Similarly, when an FTA between $i(i = 1, 2)$ and 3 is formed, small country i improves its social welfare through the FTA[i3], and outside country $j(j \neq i)$ is also better off due to positive externalities. However, large country 3 might be worse off as a result of the FTA with small country i. If the demand level of country 3 is sufficiently large, the social welfare of country 3 would decrease with FTA [i3]. We assume

$$(a_3)^2 > \frac{117}{70}(\underline{a})^2. \tag{7}$$

When Condition (7) is satisfied, we have $W_3^{[13]} < W_3^I$.

Furthermore, the social welfare of country 3 at FTA [12] may be greater than that under global free trade if $(a_3)^2 > (220/147)(\underline{a})^2$. Because this condition is always satisfied if Condition (7) is satisfied, we have $W_3^{[12]} > W_3^F$.

(**FTA**[12] $\rightarrow$ **FTA**[12][i3]) We consider the situation in which an FTA between countries 1 and 3 is added to FTA [12]. We denote this state as FTA [12][13]. In this case, countries 2 and 3 impose $\tau_{23} = a_2/7$ and $\tau_{32} = a_3/7$. Therefore, we obtain

$$\begin{aligned}
W_1^{[12][13]} &= \left[\frac{11}{32}(a_1)^2 + \frac{4}{49}(a_2)^2 + \frac{4}{49}(a_3)^2\right], \\
W_2^{[12][13]} &= \left[\frac{5}{14}(a_2)^2 + \frac{1}{16}(a_1)^2 + \frac{1}{49}(a_3)^2\right], \\
W_3^{[12][13]} &= \left[\frac{5}{14}(a_3)^2 + \frac{1}{16}(a_1)^2 + \frac{1}{49}(a_2)^2\right].
\end{aligned}$$

From $a_3 > a_1$, the social welfare for country 1 is increased by the adoption of an FTA between 1 and 3, i.e., $W_1^{[12]} < W_1^{[12][13]}$. On the other hand, we can show that the social welfare of country 3 is decreased by the adoption of FTA [13], from $a_3 > a_1$. That is, $W_3^{[12]} > W_3^{[12][13]}$.

We can see changes in social welfare from FTA [12] to FTA [12][23] in the same way because country 1 is symmetric with country 2.

(FTA $[i3] \rightarrow$ FTA $[i3][ij]$ or FTA $[i3][j3]$) Next, we consider the situation in which an FTA is adopted when another FTA between small country i ($i = 1, 2$) and large country 3 already exists.

Let us focus on FTA[13]. We can show that $W_2^{[13][23]} > W_2^{[13]} > W_2^{[13][12]}$. The new participant (country 2) obtains greater social welfare by forming an FTA with a large country than it would with a small country. The outsider can enjoy the positive externalities. When country 2 forms an FTA with a small country (country 1), the benefit is smaller than the positive externalities. Therefore, country 2 is worse off in this period from forming FTA[12][4].

If $(a_3)^2 < (936/175)(\underline{a})^2$, we have $W_3^{[13][23]} > W_3^{[13]}$. Because we consider the situation in which global free trade is efficient (Condition (6)), this condition is always satisfied. Therefore, the large country may be better off as the hub. On the other hand, we have $W_3^{[13][12]} < W_3^{[13]}$. Therefore, county 3 is worse off as the spoke.

We can see changes in social welfares from FTA [23] to FTA [23][12] and from FTA [23] to FTA [23][13] in the same way because country 1 is symmetric with country 2.

(FTA$[ij][ik] \rightarrow$ the global free trade) Because $a_3 > \underline{a}$, we have $W_2^F > W_2^{[12][13]}$. This means that country 2 prefers an FTA with county 3 to the status-quo. Similarly, we can show that $W_1^F > W_1^{[12][23]}$.

If a_3 is not too large, global free trade is also desirable for country 3. The condition is $(a_3)^2 < 22/7(\underline{a})^2$, which is satisfied under Condition (6).

[4] Although the trading bloc [12] provides no benefit to country 2 in this period, it may provide the benefit of global free trade to country 2 in the future because $W_2^F > W^{[13]}$.

Therefore $W_3^F > W_3^{[12][13]}$.

3.2 Equilibrium FTA

Under condition (6) and (7), we construct an SSPE in which a partial trading bloc with a FTA between countries 1 and 2 emerges and global free trade is not achieved. The equilibrium strategy profile σ^* in the FTA round is as follows:

(i) In the initial state (no FTA), country 1 or 2 offers FTA[12] as a proposer. Countries 1 and 2 accept the proposal. On the other hand, country 3 chooses the status quo. Thus, country 3 offers no FTA with other countries. In addition, country 3 rejects any proposal for FTAs from countries 1 and 2.

(ii) In the state with an FTA between small countries, FTA [12], when country 1 or 2 is a proposer, the country offers an FTA with country 3. However, country 3 rejects the proposal. When country 3 is a proposer, it offers no FTA even if countries 1 and 2 accept the proposal from country 3.

(iii) In the state with an FTA between a small country and a large country, FTA [13], if country 1 or 3 is a proposer, it proposes an FTA with country 2. When country 1 or 3 is a responder, it accepts the offer from country 2. When country 2 is a proposer, it offers a FTA with country 3. When country 2 is a responder, it always accepts the offer from country 3, but only accepts the offer from country 1 if $\delta \in [\hat{\delta}, 1)$. Country 2 rejects the offer from country 1 if $\delta \in [0, \hat{\delta})$. The strategy profile of FTA[23] is given in the same way by interchanging country 1 with country 2.

(iv) In the state with FTA[12][13], country 2 or 3 proposes FTA[23] as a proposer. The other accepts the proposal.

According to the above strategy profile, only the FTA between 1 and 2 is

realized with probability one. Thus, a partial trading bloc emerges. We can show that the above strategy profile is supported as an SSPE of the game for a small discount factor $\delta < \underline{\delta}$ and for a large discount factor $\delta > \bar{\delta}$. Formally,

Proposition 1. *Suppose that conditions (6) (7) are satisfied. For some* $\underline{\delta}$ *and* $\bar{\delta}$*, (i) there exists an SSPE for any* $\delta \in [0, \underline{\delta}]$ *in which the economy converges to FTA*[12] *almost surely, and (ii) there also exists an SSPE for any* $\delta \in [\bar{\delta}, 1)$*, in which the economy converges to FTA*[12] *almost surely.*

Proof. See Appendix.

If country 3 is sufficiently impatient, the future gain from global free trade does not matter to it. Because the current payoff from choosing to stand alone is larger than that from forming FTA[13] ($W_3^I > W_3^{[13]}$), country 3 chooses to be an outsider rather than forming FTAs.

If all countries are sufficiently patient and if country 3 accepts the offer from 1, the hub-and-spoke pattern will be formed in the next period and then global free trade will be achieved. If country 3 rejects the offer from country 1, the most favorable state [12] for country 3 will be reached with probability 2/3 in the next period. If country 3 is sufficiently patient, 3 can wait until the FTA [12] is formed.

The reason why global free trade cannot be achieved is that the large country 3 prefers to be an outsider, because it benefits from positive externalities of FTA[12]. Rather than barring country 3 from the FTA, countries 1 and 2 propose that it join but country 3 chooses to be alone[5].

Burbidge et al.,(1997) develop a coalition formation game with transfer payments in a capital tax competition model and provide an example in

[5]Ornelas (2005) obtains similar results in which nonmembers may hinder global free trade using a "war of attrition" model.

which the grand coalition fails to be formed. In contrast to our paper, their example has negative externalities and the trading bloc [12] prevents country 3 to enjoy capital monopoly power. Because Birbidge et al. analyze the coalition formation as simultaneous-move games, the strategic formation of a subcoalition is lacking and the sharing rule in their model is based on a cooperative bargaining solution.

Proposition 1 implies that global free trade may not be achieved through bilateral agreements without transfers. Therefore, multilateral bargaining or transfer payments among countries are needed to achieve global free trade. In the following section, we show that global free trade is achieved if transfer payments are possible, but another problem concerning inequality of allocation among countries can arise.

4 Inequality of Social Welfares

4.1 FTAs with transfers: Negative externalities

In this section, we allow transfers between countries through their FTAs. We show that, although global free trade is realized by allowing transfers between countries, inequality of social welfare is exacerbated by bilateral FTAs.

All countries behave independently in the initial state. If countries i and j form an FTA and country k stands alone, which is denoted by $\mathrm{FTA}^T[ij]$, the two-country trading bloc chooses tariffs on imports from country k to maximize the joint welfare of member countries and distributes the aggregate social welfare through transfers between members. At $\mathrm{FTA}^T[ij]$, country i sets $\tau_{ik} = (5/19)a_i$, country j sets $\tau_{jk} = (5/19)a_j$, and country k sets $\tau_{ki} = \tau_{kj} = (3/10)a_k$. If there exist two FTAs among three countries, they set all their tariffs at zero because they maximizes the joint social welfare of the

three countries. Therefore, we identify a state with two FTAs: FTA$^T[ij][ik]$, FTA$^T[ij][jk]$, and FTA$^T[ik][jk]$ with global free trade. The joint welfare of countries i and j at FTA$^T[ij]$ is given by

$$W_i^{T[ij]} + W_j^{T[ij]} = \frac{323}{722}(a_i)^2 + \frac{323}{722}(a_j)^2 + \frac{1}{50}(a_k)^2, \tag{8}$$

and the social welfare of country k is

$$W_k^{T[ij]} = \frac{2}{5}(a_k)^2 + \frac{1}{361}(a_i)^2 + \frac{1}{361}(a_j)^2. \tag{9}$$

It is easy to see that $W_i^I + W_j^I < W_i^{T[ij]} + W_j^{T[ij]}$ and $W_k^I > W_k^{T[ij]}$ for any a_i, a_j and a_k. Thus, two countries forming a trading bloc decrease the social welfare of the outside country. This means that the formation of an FTA has *negative externalities* when transfers between countries are allowed. In global free trade, the aggregate social welfare per period is represented by

$$W_i^F + W_j^F + W_k^F = \frac{15}{32}(a_i)^2 + \frac{15}{32}(a_j)^2 + \frac{15}{32}(a_k)^2.$$

The state with global free trade (F) Pareto-dominates all other states; the initial state (I), FTA$^T[12]$, FTA$^T[13]$, and FTA$^T[23]$.

4.2 First-mover advantage

We provide an example in which the ex post inequality of social welfare among countries occurs in equilibrium even if all countries are identical; $a_i = a_j = a_k = a$.

Let us define the discounted total per-period social welfare for all countries if global free trade continues forever by

$$V(N;\{N\}) = \frac{1}{1-\delta}\left(W_i^F + W_j^F + W_k^F\right).$$

The discounted sum of aggregate social welfare for countries i and j and that of country k at FTA$^T[ij]$ are denoted by

$$V(\{i,j\};[ij],k)=\frac{1}{1-\delta}(W_i^T[ij]+W_j^T[ij]),\quad V(\{k\};[ij],k)=\frac{1}{1-\delta}W_k^{T[ij]}.$$

Suppose that the discounted total welfare allocation to countries i, j, and k under the FTA$[ij]$ is $(y_i^{[ij]},y_j^{[ij]},y_k^{[ij]})$, where $y_i^{[ij]}+y_j^{[ij]}=V(\{i,j\};[ij],k)$ and $y_k^{[ij]}=V(\{k\};[ij],k)$. The corresponding allocation per period is represented by $((1-\delta)y_i^{[ij]},(1-\delta)y_j^{[ij]},(1-\delta)y_k^{[ij]})$. By definition, $(1-\delta)y_k^{[ij]}=W_k^{[ij]}$.

We refer to an SSPE $\delta\to 1$ as a limit SSPE. We show that the following strategy combination σ^T is supported as a limit SSPE of the game:

(i) In the initial state, proposer i $(i=1,2,3)$ offers country j an FTA that gives j the per-period social welfare,

$$(1-\delta)\left[W_j^I+\frac{1}{3}\delta V(\{ij\};[ij],k)+\frac{1}{3}\delta V(\{k\};[ij],k)\right].$$

Country j proposes an FTA with country k that gives the per-period social welfare,

$$(1-\delta)\left[W_k^I+\frac{1}{3}\delta V(\{jk\};[jk],i)+\frac{1}{3}\delta V(\{i\};[jk],i)\right],$$

and country k proposes an FTA with country i that gives the per-period social welfare,

$$(1-\delta)\left[W_i^I+\frac{1}{3}\delta V(\{ik\};[ik],k)+\frac{1}{3}\delta V(\{j\};[ik],j)\right].$$

Because all countries are symmetric, every country j accepts the proposal if and only if the offered social welfare is at least

$$(1-\delta)\left[W_j^I+\frac{1}{3}\delta V(\{ij\};[ij],k)+\frac{1}{3}\delta V(\{k\};[ij],k)\right].$$

(ii) In the state with FTA$^T[ij]$ and an allocation of per-period social welfare $((1-\delta)y_i^{[ij]},(1-\delta)y_j^{[ij]},(1-\delta)y_k^{[ij]})$, every country offers global free trade

(the grand coalition) and an allocation in which the other two countries have only their continuation payoffs of the game. The responder accepts the offer if and only if the proposed level of social welfare is greater than or equal to its continuation payoff. The discounted sum of continuation payoff for player i at $\mathrm{FTA}^T[ij]$ is

$$\frac{1}{3}(V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k)) + y_i^{[ij]}.$$

Proposition 2. *Suppose that $\delta \to 1$ and $a_i = a_j = a_k$. A strategy profile σ^T is a limit SSPE in which country i which is selected as a proposer obtains the social welfare of $(1/3)V(N;\{N\})+(1/3)V(\{ij\};[ij],k)-(2/3)V(\{k\};[ij],k))-W_j^I$. Opponent j of the FTA with country i obtains social welfare of $(1/3)V(N;\{N\})+W_j^I$, and country k which is the last to join the FTA obtains social welfare of $(1/3)V(N;\{N\}) - (1/3)V(\{ij\};[ij],k) + (2/3)V(\{k\};[ij],k)$ where $i,j,k \in \{1,2,3\}$ are distinct numbers.*

Proof. See Appendix.

Because $(1/3)V(\{ij\};[ij],k) - (2/3)V(\{k\};[ij],k)) - W_j^I > W_j^I$, the first proposer's social welfare is strictly greater than the opponent of the FTA in the first period, and the final participant's social welfare is strictly smaller than $(1/3)V(N;\{N\}) + W_j^I$. This result suggests that there exists a first-mover advantage.

When transfers among countries in the same trading bloc are possible, global free trade is achieved through the bilateral bargaining. But Proposition 2 says that the benefit from global free trade is divided unequally. The country which is selected as a proposer in the first period obtains the largest welfare, the country which is the opponent of the FTA in the first period obtains the second largest welfare and the last participant to the FTA

in the second period obtains the smallest welfare. Therefore, the bilateral bargaining induces ex-post inequalities among countries if there are negative externalities of FTAs.

A similar result has been obtained by Macho-Stadler and Xue (2007). When two countries first form a trading bloc, the payoff for the third country which is excluded from in the first round, results in the worst payoff in the grand coalition. Although we determine the payoff allocation endogenously through a dynamic bargaining game, Macho-Stadler and Xue assume the surplus generated by coalition formation to be shared equally among its members.

We employ the random proposers bargaining procedure of Okada (2000). Okada also examines the *first-mover rent* in renegotiations. He shows that strategic behavior in the process of renegotiation may distort the equity of an agreement. However, there are no externalities in his model. We apply his model to the international trade literature and extend it to a game with externalities.

4.3 Expansion of inequalities

In the previous subsection, we assumed that all countries are identical and focused on the ex post inequalities of social welfare. Even if all countries are identical, the ex-post social welfare among countries differs due to negative externalities, but the ex ante social welfare is the same for all countries. However the problem of ex ante inequalities would arise with asymmetric countries. In this subsection, we assume $a_1 < a_2 < a_3$ and show that the inequalities between countries are expanded.

We provide an example in which the ex ante inequalities of social welfare among countries are expanded in comparison with the initial state through

negotiations of the bilateral FTAs. We denote the equilibrium (ex ante) expected social welfare for country i in the initial state as v_i^I, $i = 1, 2, 3$. If there is never an FTA, each country i has the discounted sum of social welfare of W_i^I.

The equilibrium strategy profile $\hat{\sigma}$ is as follows. In the initial state, country 1 proposes an FTA to country 3; country 2 also proposes an FTA to country 3, and country 3 offers an FTA to country 2. After a two-country trading bloc is created, global free trade is realized whichever country becomes the proposer. As the discount factor δ is close to zero, the proposer extracts all surplus from the FTA. It is optimal for countries 1 and 2 to propose an FTA with country 3 because $V(\{13\}; [13], 2) > V(\{12\}; [12], 3)$ and $V(\{23\}; [23], 1) > V(\{12\}; [12], 3)$. Then, country i ($i = 1, 2$) receives $V(\{i3\}; [i3], j) - W_3^I$. If an FTA between i and 3 is adopted, the outside country j ($j = 1, 2$) receives $W_j^T[i3]$. Similarly, it is optimal for country 3 to offer an FTA with country 2 because $V(\{23\}; [23], 1) > V(\{13\}; [13], 2)$. Then, country 3 gets the social welfare of $V(\{23\}; [23], 1) - W_2^I$. Hence, as $\delta \to 0$, the ex ante social welfare of each country converges to

$$
\begin{aligned}
v_1^I &= \frac{1}{3}(V(\{13\}; [13], 2) - W_3^I) + \frac{2}{3}W_1^{T[23]}, \\
v_2^I &= \frac{1}{3}(V(\{23\}; [23], 1) - W_3^I) + \frac{1}{3}W_2^I + \frac{1}{3}W_2^{T[13]}, \\
v_3^I &= \frac{1}{3}(V(\{23\}; [23], 1) - W_2^I) + \frac{2}{3}W_3^I.
\end{aligned}
$$

It follows from (5) and (8) that $v_3^I - v_2^I > W_3^I - W_2^I$ and $v_2^I - v_1^I > W_2^I - W_1^I$. Thus, we obtain the following proposition.

Proposition 3. *Suppose that $a_1 < a_2 < a_3$. The gap between the ex ante social welfare of the largest country and that of the other countries is widened in a unique SSPE as the discount factor is close to zero, $((v_3^I - v_2^I) > (W_3^I - W_2^I)$ and $(v_2^I - v_1^I) > (W_2^I - W_1^I))$.*

The expansion of inequalities is caused by the strategic behavior whereby every country prefers to forme an FTA with a large country because it can access the large country's market without tariffs. Because any proposer in the first period chooses to ratify an FTA with a large country, the large country is certain to join the trading bloc at first and it escapes negative externalities. Therefore, the large country has strong bargaining power and the (ex ante) inequality between the large country and the small countries is exacerbated.

5 Conclusion

In this paper, we show that a bilateral FTA may fail to achieve global free trade without transfers between members. When transfers are possible, global free trade is eventually achieved, but the imbalance of bargaining power induces an unequal allocation of welfare. Even when the countries are symmetric, ex post welfare differs among countries because of the first-mover advantage. Moreover, if the countries are asymmetric, the ex ante welfare is different due to strategic bargaining. Because each country wants an FTA with the large country, the large country has a strong bargaining position and obtains the largest surplus from global free trade. As a result, the difference in social welfare between countries widens. Therefore, this paper suggests that a multilateral enforcement mechanism such as the WTO is important to achieve global free trade and to promote a more cooperative outcome.

The present paper has focused on homogeneous goods and varying country size. Our noncooperative bargaining model will be extended to analyze an economy with complementary and composite goods. Recently, the pattern of FTAs has diversified. Some are FTAs between countries whose key indus-

tries are very different, such as that between Japan and Brunei. Therefore, further research is necessary for FTAs between economically divers countries in the context of noncooperative coalitional bargaining games.

Appendix

Proof of Proposition 1.

Proof. We prove the proposition by backward induction.

(a) First, let us focus on the state with FTA[12][13]. In this state, countries 2 or 3 is selected as proposer with a probability of 1/2. We verify that the following strategy for country 2 and 3 is optimal with FTA[12][13]. Country 2 (or 3) offers country 3 (or 2) an FTA and it accepts the proposal. Note that $W_2^F > W_2^{[12][13]}$ and $W_3^F > W_3^{[12][13]}$ under $a_3 > a_2$ and Condition (7). Suppose that country 3 deviates from acceptance to rejection. If country 3 rejects the proposal, then country 3 obtains a discounted current value of social welfare such as $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F$. On the other hand, by accepting, country 3 receives $W_3^F/(1-\delta)$. From $W_3^F > W_3^{[12][13]}$, it follows that $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F < W_3^F/(1-\delta)$. Thus, the deviating to rejection is not profitable for country 3. It is easy to see that the rejection is not profitable for country 2 in the same way because $W_2^F > W_2^{[12][13]}$.

If country 3 chooses the status quo as proposer instead of proposing an FTA to country 2, country 3 obtains social welfare $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F$, which is less than $W_3^F/(1-\delta)$. Therefore, it is optimal for country 3 to propose an FTA to country 2. Similarly, we can see that selection of the status quo for country 2 is not a profitable deviation because $W_2^{[12][13]} + (\delta/(1-\delta))W_2^F < W_2^F$.

We can apply the same approach to FTA[12][23] and FTA[13][23] because

$W_1^F > W_1^{[12][23]}$, $W_3^F > W_3^{[12][23]}$ and $W_1^F > W_1^{[13][23]}$, $W_2^F > W_2^{[13][23]}$.

(b) Second let us examine the state with FTA[12]. We see that countries 1 and 2 propose an FTA with country 3, and accept a proposal by country 3 and that country 3 chooses the status quo as a proposer and rejects offers from countries 1 and 2 in their optimal strategies. Thus, we show that the state with FTA[12] is an absorbing state. If country 3 accepts the proposal by country 1 or 2, the economy goes to FTA[12][13] or FTA[12][23]. By part (a) of this proof, global free trade would be realized with probability one in the next period. Therefore, by accepting the proposal, country 3 obtains social welfare of $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F$. On the other hand, if country 3 rejects the proposal, the social welfare is $W_3^{[12]}/(1-\delta)$. We should note that $W_3^{[12]} > W_3^{[12][13]}$ and $W_3^{[12]} > W_3^F$. It is follows that $W_3^{[12]}/(1-\delta) > W_3^{[12][13]} + (\delta/(1-\delta))W_3^F$. This implies that rejection is optimal for country 3. Proposing an FTA with country 3 or choosing the status quo is indifferent for countries 1 and 2 because the offer would be rejected by country 3.

Country 3 as a proposer receives the social welfare of $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F$ by offering an FTA with country 1 and that of $W_3^{[12]}/(1-\delta)$ by choosing of the status quo. Because $W_3^{[12][13]} + (\delta/(1-\delta))W_3^F < W_3^{[12]}/(1-\delta)$, country 3 has no incentive to offer FTAs to counties 1 or 2.

(c) Third, we consider the state with FTA[13] and FTA[23]. We focus on the state with FTA[13]. If country 1 or 3 is a proposer, it offers country 2 an FTA because $W_1^{[13][12]} > W_1^{[13]}$ and $W_3^{[13][23]} > W_3^{[13]}$. When country 1 or 3 is a responder, it accepts the offer from country 2. When country 2 is a proposer, it offers country 3 an FTA because $W_2^{[13][23]} > W_2^{[13][12]}$. If country 2 is a responder, country 2 accepts the offer from country 3 because $W_2^{[13][23]} > W_2^{[13]}$, but whether country 2 accepts or rejects the offer from country 1 depends on the discount factor δ because $W_2^{[13]} > W_2^{[13][12]}$.

If country 2 accepts the offer from country 1, global free trade will be achieved in the next period. Thus, country 2 can obtain the social welfare $W_2^{[13][12]} + (\delta/(1-\delta))W_2^F$ by accepting the offer from country 1. On the other hand. if country 2 rejects the offer, it obtains $W_2^{[13]} + \delta v_2^{[13]}$, where $v_2^{[13]}$ is the expected social welfare for country 2 in the game from the state with FTA[13]. Therefore, there exists some $\hat{\delta}$ such that $W_2^{[13][12]} + (\delta/(1-\delta))W_2^F > W_2^{[13]} + \delta v_2^{[13]}$ for any discount factor $\delta \in [\hat{\delta}, 1)$.

We denote the candidate strategy profile by σ^* and the expected social welfare for country i by $v_i^{[13]}(\sigma^*)$ starting from FTA [13] under σ^*. If $\delta \geq \hat{\delta}$, all countries accept the FTA offer. From the optimal strategy for country 2, FTA [13][12] is formed with probability 1/3 and FTA[13][23] is formed with probability 2/3. If $\delta < \hat{\delta}$, country 2 rejects the offer from country 1. Thus, the expected social welfare for country 3 is

$$v_3^{[13]}(\sigma^*) = \frac{1}{3}\left(W_3^{[13]} + \delta v_3^{[13]}(\sigma^*)\right) + \frac{2}{3}\left(W_3^{[13][23]} + \frac{\delta}{1-\delta}W_3^F\right) \quad \text{if} \quad \delta < \hat{\delta}$$

It follows that

$$v_3^{[13]}(\sigma^*) = \begin{cases} \frac{1}{3}\left(W_3^{[13][12]} + \frac{\delta}{1-\delta}W_2^F\right) + \frac{2}{3}\left(W_3^{[13][23]} + \frac{\delta}{1-\delta}W_2^F\right) & \text{if} \quad \delta \geq \hat{\delta} \\ \frac{1}{3-\delta}\left(W_3^{[13]} + 2W_3^{[13][23]} + \frac{2\delta}{1-\delta}W_3^F\right) & \text{if} \quad \delta < \hat{\delta}. \end{cases} \tag{A-1}$$

(d) Finally, let us check the strategies in the initial state. We denote i's expected social welfare under σ^* starting from the initial sate as $v_i^I(\sigma^*)$. If country 1 (or 2) accepts the offer of country 2 (or 1), it obtains social welfare of $W_1^{[12]}$ from part (b) of the proof. Even if country 1 rejects the offer, country 1 obtains $W_1^I + \delta v_1^I(\sigma^*)$. Because $v_1^I(\sigma^*) \leq W_1^{[12]}/(1-\delta)$ and $W_1^I \leq W_1^{[12]}$, $W_1^I + W_1^{[12]}/(1-\delta) > W_1^I + \delta v_1^I(\sigma^*)$. Thus, country 1 accepts the proposal. Moreover, if country 3 offers country 1 (or 2) an FTA and country 1 (or 2)

accepts, the social welfare for country 1 (or 2) is given by

$$W_1^{[13]} + \delta \left[\frac{1}{3}(W_1^{[13][12]} + \frac{\delta}{1-\delta} W_1^F) + \frac{2}{3}(W_1^{[13][23]} + \frac{\delta}{1-\delta} W_1^F) \right]$$

On the other hand, if country 1 rejects the offer, country 1 obtains $W_1^I + \delta v_1^I(\sigma^*)$. Because the social welfare from rejecting the offer is less than that obtained by accepting it, acceptance is optimal for country 1.

Next, we will show that it is optimal for country 3 to reject the offer from countries 1 and 2. If country 3 rejects the proposal, country 3 has the social welfare of $W_3^I + \delta v_3^I(\sigma^*)$. By definition of σ^*, we have

$$v_3^I(\sigma^*) = \frac{2}{3}\frac{1}{1-\delta} W_3^{[12]} + \frac{1}{3}\left(W_3^I + \delta v_3^I(\sigma^*)\right), \tag{A-2}$$

where the first term is the expected social welfare of country 3 when country 1 or 2 becomes a proposer and the second term is the expected social welfare when country 3 is a proposer. On the other hand, the social welfare of country 3 if it accepts the proposal by country 1 (or 2) is $W_3^{[13]} + \delta v_3^{[13]}(\sigma^*)$, where $v_3^{[13]}(\sigma^*)$ is given by (A-1).

Note that $W_3^{[13]} < W_3^I$ and that $\lim_{\delta \to 0} \delta v_3^I(\sigma^*) = 0$ and $\lim_{\delta \to 0} \delta v_3^{[13]}(\sigma^*) = 0$. Therefore, for some $\underline{\delta} \in [0, 1)$, for any $\delta < \underline{\delta}$, we have $W_3^I + \delta v_3^I(\sigma^*) > W_3^{[13]} + \delta v_3^{[13]}(\sigma^*)$. Thus, it is optimal for country 3 to reject the proposal. When country 3 is the proposer, we can see that country 3 has the social welfare of $W_3^{[13]} + \delta v_3^{[13]}(\sigma^*)$ if he proposes an FTA with country 1 or 2 and has $W_3^I + \delta v_3^I(\sigma^*)$ if it proposes the status quo. Therefore, we can apply the same argument. This completes the proof of (i) in Proposition 1.

From (A-2), we have

$$v_3^I(\sigma^*) = \frac{1}{3-\delta}\left[\frac{2}{1-\delta} W_3^{[12]} + W_3^I\right].$$

Therefore, $v_3^I(\sigma^*)$ is increasing in δ. In addition, $v_3^{[13]}(\sigma^*)$ is increasing in δ

from (A-1). We can see that

$$\lim_{\delta\to 1}(1-\delta)v_3^{[13]}(\sigma^*) = W_3^F < W_3^{[12]} = \lim_{\delta\to 1}(1-\delta)v_3^I(\sigma^*).$$

Then, we obtain that $v_3^I(\sigma^*) > v_3^{[13]}(\sigma^*)$ as $\delta \to 1$ from $(1-\delta) > 0$. Furthermore, $W_3^{[13]} < W_3^I$. We conclude that for some $\bar{\delta} \in [0,1)$, for any $\delta \in (\bar{\delta}, 1)$,

$$W_3^{[13]} + \delta v_3^{[13]}(\sigma^*) < W_3^I + \delta v_3^I(\sigma^*).$$

This implies that it is optimal for country 3 to reject the proposal as $\delta \to 1$ in the initial state. We can see that proposing the status-quo is optimal for country 3 as δ is close to one in the same way. This completes the proof of (ii) in Proposition 1. □

Proof of Proposition 2.

Proof. Suppose that there is an FTA between i and j in the second period and the status quo allocation of payoffs is $(y_i^{[ij]}, y_j^{[ij]}, y_k^{[ij]})$. Each country becomes a proposer with equal probability. When δ is close to one, the proposer should offer to divide the net gain from adding country k to the FTA$[ij]$, $V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k)$, equally among three countries. If country i uses the strategy described in the proposition, country i receives

$$v_i^{[ij]} = \frac{1}{3}\left(V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k)\right)) + y_i^{[ij]}. \qquad \text{(A-3)}$$

If country i deviates from the equilibrium strategy and chooses the status-quo, it receives

$$(1-\delta)y_i^{[ij]} + \delta v_i^{[ij]}(\sigma^T) = y_i^{[ij]} + \frac{1}{3}\delta\left(V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k))\right),$$

which is less than $v_i^{[ij]}(\sigma^T)$. Thus, it is optimal for country i to propose an FTA with country k and for country k to accept the offer. Therefore, the

strategy profile of (ii) is the optimal strategy and global free trade is achieved at the second period.

Next, let us verify the optimality of (i). Suppose that country j is a responder at the first period. If country j rejects the offer of country i, the bargaining game goes to the next period and j receives the expected social welfare of $W_j^I + \delta v_j^I(\sigma^T)$. Then, if an offer by country i is greater than $W_j^I + \delta v_j^I(\sigma^T)$, it is optimal for country j to accept. It follows that

$$(1-\delta)y_j^{[ij]} + \delta\left[\frac{1}{3}\left\{V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k))\right\} + y_j^{[ij]}\right] = W_j^I + \delta v_j^I(\sigma^T)$$

Note that the strategy profile σ^T gives the same ex-ante expected social welfare to all counties and $v_j^I(\sigma^T)$ converges $(1/3)V(N;\{N\})$ as $\delta \to 1$. Solving for y_i gives us

$$y_j^{[ij]} = W_j^I + \frac{1}{3}\delta V(\{ij\};[ij],k) + \frac{1}{3}\delta V(\{k\};[ij],k). \tag{A-4}$$

Thus, it is optimal for country j to accept i's offer if country j can obtain at least

$$(1-\delta)y_j^{[ij]} = (1-\delta)\left[W_j^I + \frac{1}{3}\delta V(\{ij\};[ij],k) + \frac{1}{3}\delta V(\{k\};[ij],k)\right]$$

per period from the FTA with country i.

Finally, consider the strategy of (i) when country i is a proposer in the first period. Given the response rule of other countries, proposer i offers the opponent j to give the least continuation social welfare of $(1-\delta)(W_j^I + (1/3)\delta V(\{ij\};[ij],k) + (1/3)\delta V(\{k\};[ij],k))$ and to obtain all residual surplus. It follows that country i obtains

$$(1-\delta)y_i^{[ij]} = (1-\delta)\left[V(\{ij\};[ij],k) - W_j^I + \frac{1}{3}\delta V(\{ij\};[ij],k) + \frac{1}{3}\delta V(\{k\};[ij],k)\right]$$

in the first period by forming FTA$[ij]$. Thus, the discounted sum of social welfare for i is

$$(1-\delta)y_i^{[ij]} + \delta\left(\frac{1}{3}\left(V(N;\{N\}) - V(\{ij\};[ij],k) - \delta V(\{k\};[ij],k)\right) + y_i^{[ij]}\right)$$
$$= \frac{1}{3}V(N;\{N\}) + V(\{ij\};[ij],k) - \frac{2}{3}\delta V(\{ij\};[ij],k) - \frac{2}{3}\delta V(\{k\};[ij],k) - W_j^I. \tag{A-5}$$

If proposer i chooses the status-quo, country i obtains

$$W_i^I + \delta\frac{1}{3}V(N;\{N\}). \tag{A-6}$$

As $\delta \to 1$, (A-5) $\geq$ (A-6). Thus, the expected social welfare for country i is larger than that in the status quo and (i) is the optimal strategy for country i.

From (A-5), the expected social welfare for country i when country i is a proposer in the first period converges to

$$\frac{1}{3}V(N;\{N\}) + \frac{1}{3}\delta V(\{ij\};[ij],k) - \frac{2}{3}V(\{k\};[ij],k) - W_j^I$$

as $\delta \to 1$.

From (A-3) and (A-4), the expected social welfare for country j when country j is a responder in the first period converges to

$$\frac{1}{3}V(N;\{N\}) + W_j^I$$

as $\delta \to 1$.

From (A-3), the expected social welfare for country k when country k joins the FTA in the second period is

$$W_k^{[ij]} + \delta\left[\frac{1}{3}\left(V(N;\{N\}) - V(\{ij\};[ij],k) - V(\{k\};[ij],k)\right) + \frac{W_k^{[ij]}}{1-\delta}\right].$$

Using $W_k^{[ij]} + (\delta/(1-\delta))W_k^{[ij]} = V(\{k\};[ij],k)$, the expected social welfare for country k converges to

$$\frac{1}{3}V(N;\{N\}) - \frac{1}{3}V(\{ij\};[ij],k) + \frac{2}{3}V(\{k\};[ij],k)$$

as $\delta \to 1$. □

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