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The Most Favored Nation Principle: Passive Constraint or Active Commitment?*

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This study examines how the welfare implication of the "most-favored-nation" (MFN) principle changed when the trade agreement mode shifted from a "one-shot-multilateral-trade-agreement" to "sequential-bilateral-trade-agreements." It emphasizes that the MFN principle works as "passive constraints" in the former but "active commitments" in the latter. Under the sequential-bilateral-trade-agreements, (i) an importing country strategically takes a cost-efficient country as its first (second) trading partner when the MFN principle is (not) embedded, and (ii) embedding the MFN clause improves the trade surplus of the importing country and the world economy. The MFN principle is utilized by the cost-efficient country as a commitment device to encourage production. This principle reverses the welfare implication in the existing literature. Finally, the importing country prefers the sequential agreements with the MFN clause to other cases in which it can choose simultaneous or sequential agreements with/without the MFN clause.

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I. Introduction

The General Agreement on Tariffs and Trade (GATT) has raised significant and enduring concerns among policy makers and trade economists, especially with regard to Article I of GATT and its exception provision Article XXIV. In particular,

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the former, so-called most-favored-nation (MFN) principle, requires that tariffs be applied, on a non-discriminatory basis, to all member countries of the World Trade Organization (WTO), whereas the latter permits concessions on a mutually advantageous basis in regional trade agreements (RTAs). Interestingly, in spite of the latter's purpose to encourage bilateral trade agreements, the MFN provisions are often embedded in many RTAs. Motivated by the paradoxically widespread embedding of the MFN clause in many RTAs,[1] this paper re-examines the welfare implication of the MFN principle in the context of "sequential bilateral trade agreements" as well as the "one shot multilateral trade agreement." We observe, when the MFN principle is utilized as a commitment device to encourage production by the cost-efficient trading partner in sequential bilateral trade agreements, a reversal of the welfare implication in the previous literature.

Brander and Spencer (1984) document that rent-extracting tariffs can improve an importing country's domestic welfare when exporting countries are engaged in oligopolistic competition. By extending their framework, Gatsios (1990) and Hwang and Mai (1991) demonstrate that an importing country dealing with asymmetric exporting countries generally prefers to impose preferential rather than uniform tariffs, the former being associated with more policy instruments. The authors predict that higher tariff rates on imports from low-cost than from high-cost exporting countries under the preferential tariffs regime hurts global production efficiency, which can be improved via adoption of the MFN principle at the expense of the domestic welfare of the importing country. According to Choi (1995), used as a precommitment device to reward ex ante technology investment and thereby promote investment competition among exporting countries, adoption of the MFN clause can, to the extent that such investment serves to reduce the cost of export products, improve the importing country's long-run welfare. These seminal papers and other extensive studies are constrained, however, by their reliance on the simultaneous game structure of the one shot multilateral trade agreement, to regard the MFN principle solely as a passive constraint on the importing country.

The present study contrasts with previous work by reflecting, in attending to the game structure of "sequential bilateral trade agreements" as well as the "one shot multilateral trade agreement," the recent proliferation of RTAs. We borrow the concept of sequential trade negotiation from Aghion, Antràs, and Helpman (2007),

[1] According to recent WTO RTA notifications (www.rtais.wto.org) as of April 2015, a typical member country of the WTO has made regional trade agreements with about 20 countries so far by invoking GATT XXIV and/or GATS V. Miroudot, Sauvage, and Sudreau (2010) document that 79 percent of regional trade agreements (RTAs) in which at least one OECD country involves contain the MFN provisions and majority of them grant each party of the RTA more favorable treatments in potential RTAs by its partner. Such provisions embedded in recently established or on-going RTAs include Article 11.4 in Korea-US FTA and the service and investment chapters in the China-Australia FTA.

Seidmann (2009), and Bagwell and Staiger (2010)[2] to demonstrate that (*i*) the importing country strategically sets a cost-efficient country as the first (second) trading partner under the MFN (preferential) principle, (*ii*) the importing country can be better off by switching from the one shot multilateral agreement strategy to the sequential bilateral agreements strategy, especially when it voluntarily embeds the MFN principle in the first agreement, and (*iii*) when embedded in sequential bilateral trade agreements, the MFN principle improves both the trade surplus of the importing country and production efficiency of the world economy. Bagwell and Staiger (2010) show the structure of sequential trade negotiation to afford the leader opportunities for "forward manipulation" and the follower opportunities for "backward stealing."[3] By extending their argument, we demonstrate that sequential bilateral trade agreements that embed the MFN principle prevent "backward stealing" and encourage the (cost-efficient) first partner to export more and thereby improve the importing country's domestic, as well as the global, trade surplus. It provides a new explanation on why many countries, after experiencing the long deadlocked multilateral negotiation of the "Doha Development Agenda" (fettered by Article I of GATT), ultimately engage in sequential bilateral trade agreements rather than a one shot multilateral trade agreement, and why many RTAs that rely on Article XXIV of GATT and/or Article V of GATS voluntarily embed the MFN clause as well.

The rest of the paper is organized as follows. Section 2 presents the model and discusses the welfare implications of the inclusion and absence of the MFN clause in the one shot multilateral agreement and sequential bilateral agreements. Section 3 analyzes the role of the MFN principle as a commitment device and shows that it causes a reversal of the welfare implication. Section 4 concludes.

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[2] Aghion, Antràs, and Helpman (2007) present a dynamic bargaining game in which the payoff of every coalition is identified as a function of the coalition structure, and then show how coalition externalities affect a country's choice between sequential and multilateral negotiation. Seidmann (2009) develops a three-country bargaining model to explain how strategic positioning concern leads to various patterns of RTAs with distinguishing customs unions from free trade areas. Bagwell and Staiger (2010) highlight problems made by MFN in sequential bargaining environment in a sense of efficiency loss and explain how certain WTO provisions and its reciprocity norm can be a remedy for these problems.

[3] Bagwell and Staiger (2010) point out for the first time 'forward manipulation vs. backward stealing' issue regarding the sequential decision making process within international organizations such as WTO. They argue that the coordinator (or a coordinating country) can afford the leader opportunities for forward manipulation (to encourage the leader's export) and the follower opportunities for backward stealing by offering a more favorable condition (to encourage the follower's export). Along a similar reasoning, Herweg and Müller (2012) and Kim and Sim (2015) independently studied similar issues in vertically related market structures. They also find that the monopolistic input supplier has an incentive to exploit both forward manipulation and backward stealing in sequential contracting with downstream firms.

II. The Model

Following Brander and Spencer (1984), Gatsios (1990), and Choi (1995), we consider an oligopoly model in which one importing country ($i = H$) opens its domestic market and two asymmetric foreign countries ($i = A$ or B) export homogenous goods at per unit cost (δ_i). Without loss of generality, $\delta_A \le \delta_B$ and (δ_A, δ_B) are assumed to be public information. Country H imposes tariff $\tau_i \in \mathcal{T} := (-\infty, \infty)$ on imports from country $i \in \{A, B\}$. The inverse demand for final goods in the domestic market is given by $P(q_A + q_B) = a - b(q_A + q_B)$, where $a, b > 0$. Time is continuous with interest rate (r).

2.1. One Shot Multilateral Trade Agreement

As a benchmark, we briefly review the situation in which country *H* opens its market to both foreign countries at the same time. In stage 1, country *H* announces tariffs (τ_A, τ_B). Under the MFN principle, it should set $\tau_A = \tau_B$. In stage 2, the foreign countries decide how much to export to country *H*. To ensure that the outcome of the simultaneous game is consistent with the results of Gatsios (1990) and Choi (1995), we assume the following sufficient condition, which requires that demand be sufficiently strong compared to the marginal cost.[4] We retain this assumption unless otherwise noted.

Assumption 1 $2a \ge 5\delta_B - 3\delta_A$.

In stage 2, foreign country $i \in \{A, B\}$, taking (τ_A, τ_B) and export of other firms ($q_{i'}$) as given, chooses its own export (q_i) such that

$$q_i = \arg\max_q [P(q + q_{i'}) - \delta_i - \tau_i]q. \tag{1}$$

Given (τ_A, τ_B), the mutual best responses by both foreign countries define $q_i : \mathcal{T} \times \mathcal{T} \to \mathbb{R}_+$ such that

$$q_i(\tau_i, \tau_{i'}) = \frac{1}{3b}[a - 2\delta_i + \delta_{i'} - 2\tau_i + \tau_{i'}]. \tag{2}$$

It is assumed that once the tariff rates are determined, they cannot be changed. In

[4] This assumption guarantees that both countries export positive volumes in Cournot competition under the MFN principle. Absent this assumption, one country may not export if demand is insufficient. When the tariff rates are differentiated, $2a \ge 3\delta_B - \delta_A$ is sufficient to induce positive exports by both countries.

stage 1, country H chooses $(\tau_A, \tau_B) \in \mathcal{T} \times \mathcal{T}$ in order to maximize the present value of its domestic surplus (*DS*),

$$DS(\tau_A, \tau_B) = \frac{1}{r}\left[\int_0^{Q(\tau_A, \tau_B)} (P(q) - P(Q(\tau_A, \tau_B)))dq + \sum_i \tau_i q_i(\tau_i, \tau_{i'})\right], \tag{3}$$

where $Q(\tau_A, \tau_B) = q_A(\tau_A, \tau_B) + q_B(\tau_B, \tau_A)$.[5] The first term $(1/r)$ implies that once the trade agreement is signed by the three countries, the stage-game Nash equilibrium outcome is repeated at every instant. The global surplus (*GS*) is obtained by summing the domestic and trade surpluses of each foreign country $(\pi_i(\tau_i, \tau_{i'}))$. That is,

$$GS(\tau_A, \tau_B) = DS(\tau_A, \tau_B) + \sum_{i=A,B} \pi_i(\tau_i, \tau_{i'}). \tag{4}$$

Note that throughout the paper, only *DS*, *GS*, and π_i are expressed in the present values of the future surplus flow, whereas the other variables are expressed in per-period values. Under the MFN principle, country *H* should impose the same tariff rate on all imports from both countries, that is, $\tau_A = \tau_B = \tau \in \mathcal{T}$. Solving for the equilibrium yields

$$\tau_i^{MI} = \frac{1}{8}[2a - \delta_i - \delta_{i'}] \text{ and } q_i^{MI} = \frac{1}{8b}[2a - 5\delta_i + 3\delta_{i'}], \tag{5}$$

where superscripts "M" and "I" represent "MFN principle" and "simultaneous agreements," respectively. (A detailed derivation of the equilibrium outcome under each regime is provided in an online appendix.) Under a preferential regime, because country H may provide preferential treatment to imports from one country over those from the other, τ_A does not have to be equalized to τ_B. Solving for the equilibrium with preferential tariffs yields

[5] We posit that the importing country offers the tariff rates and the foreign exporters choose their own quantity as in linear contracting, following Brander and Spencer (1984), Gatsios (1990), Hwang and Mai (1991), and Choi (1995). This structure can be interpreted as a take-it-or-leave-it offer game, which is also understood as a bargaining game with full bargaining power on the importing country. Given our main goal to show that the MFN clause can be exploited as a means of commitment to prevent 'backward stealing', it is not that harmful to simplify the mutual bargaining procedure as a linear contracting or take-it-leave-it procedure. This reasoning leads us to proceed with the current model and use 'trade agreement' throughout the paper. However, we clearly acknowledge that our model does not have any reciprocal and mutual agreements between the governments in the importing and exporting countries.

$$\tau_i^{PI} = \frac{1}{8}[2a - 3\delta_i + \delta_{i'}], \text{ and } \; q_i^{PI} = \frac{1}{8b}[2a - 3\delta_i + \delta_{i'}], \tag{6}$$

where superscript “ P ” stands for “preferential regime.”

Proposition 1 *Suppose the importing country makes one multilateral trade agreement with both foreign countries at the same time.*
(i) $\tau_A^{PI} \geq \tau^{MI} \geq \tau_B^{PI}$.
(ii) $q_A^{MI} \geq q_A^{PI}, q_B^{MI} \leq q_B^{PI}$ *, and* $Q^{MI} = Q^{PI}$.
(iii) $DS^{MI} \leq DS^{PI}$ *and* $GS^{MI} \geq GS^{PI}$.
The equality holds only when $\delta_A = \delta_B$.

Proposition 1 implies that under the preferential principle the tariff rate levied by the importing country is higher on the efficient than on the other country, discouraging imports from the former and encouraging imports from the latter. The linear demand structure prescribes $q_A^{MI} + q_B^{MI} = q_A^{PI} + q_B^{PI}$, which is consistent with Proposition 2 in Yoshida (2000). Previous literature, such as Gatsios (1990) and Choi (1995), argues that because country H has two instruments under the preferential principle compared to one instrument under the MFN principle, domestic surplus is improved under the former. The global surplus declines, however, because the inefficient foreign country increases, and efficient foreign country reduces, exports under the preferential principle. In other words, the MFN principle improves production efficiency for the world economy, but potentially at the expense of the importing country's trade surplus. Proposition 1 is often regarded as supporting evidence for Article I of GATT.

Although it yields an insightful interpretation, the simultaneous game setting in the previous literature misses the important role of the MFN principle as a commitment device whereby each country knows that its rivals will be offered the same tariff rate, which is not necessarily the case under the preferential principle. We shed light on this role by investigating the hypothetical case in which country H differentiates tariff rates and hides from country $i \in \{A, B\}$ the tariff rate to be imposed on country $i'(\neq i)$ when country i decides how much to export. Designate by overhead ~ all variables and mappings associated with the imperfect information game. In what follows, we, by analyzing the imaginary and hypothetical case, demonstrate that $\widetilde{DS}^{PI} < DS^{MI} < DS^{PI}$, which implies that the importing country gets larger domestic surplus with ‘committed’ and ‘differentiated’ tariff rates than with a unified tariff rate (the MFN clause), but it gets less surplus with ‘non-committed’ and ‘differentiated’ tariff rates than with a uniform rate. This imaginary analysis uncovers that the result in the previous literature relies on the implicit effect of commitment.

Constructing a belief system that borrows "passive belief" from McAfee and Schwartz (1994) avoids the complicated argument on the second order belief, which is beyond the scope of this paper.[6] Suppose that whatever it is offered, country $i \in \{A, B\}$ believes that $\tilde{\tau}_{i'}^* \in \mathcal{T}$ should be levied on its rival with probability one. We characterize the belief system of country $i \in \{A, B\}$ as $\mu_i(\tilde{\tau}_{i'} = \tilde{\tau}_{i'}^*) = 1$ and $\mu_i(\tilde{\tau}_{i'} \neq \tilde{\tau}_{i'}^*) = 0$, where $\mu_i(\cdot)$ is a probability mass function of country $i \in \{A, B\}$. The belief structure is common knowledge. When it is offered $\tilde{\tau}_i$, country $i \in \{A, B\}$ chooses $\tilde{q}_i(\tilde{\tau}_i; \mu_i)$ such that

$$\tilde{q}_i(\tilde{\tau}_i; \mu_i) = \frac{1}{2b}[a - bq_{i'}(\tilde{\tau}_{i'}^*; \mu_{i'}) - \delta_i - \tilde{\tau}_i] \quad \text{for each} \quad i \in \{A, B\}. \tag{7}$$

Note that because $\tilde{\tau}_i$ is not observed by country $i'(\neq i)$, $\partial \tilde{q}_i(\tilde{\tau}_i; \mu_i) / \partial \tilde{\tau}_i = -1/(2b)$ and $\partial \tilde{q}_{i'}(\tilde{\tau}_{i'}; \mu_{i'}) / \partial \tilde{\tau}_i = 0$, which implies that if the importing country increases $\tilde{\tau}_i$ by one unit the volume of total exports decreases by $1/(2b)$ units. That we obtain $\partial q_i(\tau_i, \tau_{i'}) / \partial \tau_i = -1/(3b)$ from (2) implies that if country H raises τ_i by one unit, the volume of exports decreases by $1/(3b)$ units, which shows that the importing country is able to implicitly collect an information fee, that is, a fee for information revelation and commitment in the interim observable case.

Country H chooses $(\tilde{\tau}_A, \tilde{\tau}_B) \in \mathcal{T} \times \mathcal{T}$ to maximize the domestic surplus described in (3), which yields the first order condition with respect to $\tilde{\tau}_i$ as follows:

$$q_i(\tau_i) + (\tau_i + b(q_i(\tau_i) + q_{i'}(\tau_{i'}))) \frac{dq_i(\tau_i)}{d\tau_i} = 0, \text{ for each } i \in \{A, B\}. \tag{8}$$

Foreign country $i \in \{A, B\}$ expects country H to choose τ_i such that

$$q_i(\tau_i) + (\tau_i + b(q_i(\tau_i) + q_{i'}^e(\tau_{i'}^e))) \left(\frac{-1}{2b} \right) = 0 \quad \text{for each} \quad i \in \{A, B\}, \tag{9}$$

which requires that $q_{i'}^e(\tau_{i'}^e) = q_{i'}(\tau_{i'})$ on the equilibrium path. Equations (7) and (9) jointly determine $(\tilde{\tau}_A, \tilde{\tau}_B, \tilde{q}_A(\tilde{\tau}_A; \mu_A), \tilde{q}_B(\tilde{\tau}_B; \mu_B))$ such that

[6] McAfee and Schwartz (1994) propose that under "passive beliefs," when a downstream firm in a vertically related oligopoly market receives from the monopolistic upstream firm an offer different from what it expects in the candidate equilibrium, it does not revise its beliefs about the offers given to its rivals. In addition to "passive beliefs," they also propose "wary beliefs," under which each downstream firm thinks that others received offers that are the monopolist's optimal choices given the offer it made to that firm. In our case, the equilibrium with wary beliefs results in negative imports from one country, depending on the weight parameter of the quasi-linear preference. Thus, we restrict our attention to the case with "passive beliefs" and assume the weight parameter to be one.

$$\tilde{\tau}_i^{PI} = \frac{1}{3}[\delta_{i'} - \delta_i] \text{ and } \tilde{q}_i^{PI} = \frac{1}{3b}[a - \delta_i], \text{ for each } i \in \{A, B\}. \tag{10}$$

In equation (10), τ_B can be negative, which requires a subsidy by the country H. Since our primary goal of this subsection is to show that $\widetilde{DS}^{PI} < DS^{MI} < DS^{PI}$, we keep it as it is rather than solve another constrained optimization problem subject to the non-negativity constraint. Once we introduce the non-negativity constraint, $\widetilde{DS}^{PI}$ will be much smaller as a result of the constrained optimization.

Proposition 2 *Suppose the importing country establishes trade agreements with both foreign countries simultaneously.*
(i) $\tau^{MI} > \tilde{\tau}_A^{PI} \geq \tilde{\tau}_B^{PI}$.
(ii) $q_A^{MI} + q_B^{MI} < \tilde{q}_A^{PI} + \tilde{q}_B^{PI}$.
(iii) $DS^{MI} > \widetilde{DS}^{PI}$.

Proposition 2 demonstrates that, notwithstanding the additional policy instrument, the preferential regime without commitment is dominated by the MFN regime in terms of the domestic surplus of the importing country. Because the latter eliminates uncertainty about what are offered to their rivals, both foreign countries can increase their exports. Propositions 1 and 2 also address (i) the lack of incentive for (as well as ability of) the government of country H to hide tariff rates in the one shot multilateral trade agreement,[7] and (ii) the vulnerability of the welfare implication in Proposition 1 and the previous literature to changes in the information structure of the game.

2.2. Sequential Bilateral Trade Agreements

We now consider the case in which country H makes a bilateral trade agreement with each country sequentially. "Sequential bilateral trade agreements," unlike the "one shot multilateral trade agreement," imply a time interval, however brief, between agreements dictated by the negotiation capacity and/or strategic considerations of the government of country H. We assume a positive time interval between two bilateral trade agreements, and the length of the interval later to be zero.[8] Suppose that country H opens its market to one ("leader") foreign country

[7] It also addresses why the transparency principle was adopted together with the MFN principle in the one shot multilateral trade agreement, as to some extent by the WTO.

[8] The infinite horizon continuous time framework in the current setting is equivalent to a two period model with different discount factors. Also, most results remain unchanged as $dt \to 0$. But we proceed with this infinite horizon continuous time framework to emphasize the potential chance of extension for endogenizing the time interval between two different trade agreements.

first and to a second ("follower") foreign country after time interval $(dt(\geq 0))$. With a slight abuse of notation, we denote the leader $i=1$ and follower $i=2$. The leader monopolizes ($i=0$) until the follower enters the market. The foreign country with which country H makes an agreement sends its potential competitor a signal by making long-term contracts with other intermediate goods producers, shipping carriers, and/or local retailers. Simply, it preemptively fixes (q_0, q_1) prior to its rival's entry. When foreign exporters start exporting, they should build up the retail network and employ workers. In general, those decisions regarding the capacity are hardly reversible and require a considerable amount of adjustment cost to be rescaled. Therefore, our paper posits that in the presence of substantial adjustment cost, foreign exporters (especially the leader) make the forward-looking decision once, through which the leader can manipulate the follower's decision and exploit the first mover advantage. In light of this, the signal or commitment by the first exporter is an essential driving force in this paper.

The game proceeds as follows.

($S1$) Country H imposes tariff rate τ_i on all imports from country i. Country i fixes (q_0, q_1) through long-term contracts and immediately begins exporting.

($S2$) Country H imposes tariff rate $\tau_{i'}$ on all imports from country i'. Country i', after observing q_i, determines its own $q_{i'}$ and begins exporting.

Assumption 2 ensures that both countries participate. Note that Assumption 2 is stricter than Assumption 1, which implies a need for stronger demand in the sequential than the simultaneous game to assure imports from both countries.

Assumption 2 $3a \geq 11\delta_B - 8\delta_A$.

Suppose that country H differentiates the tariff rate on the basis of origin. Under the preferential regime, the follower, taking $(\tau_2, q_1(\tau_1))$ as given, chooses $q_2 : \mathcal{T} \times Q \to \mathbb{R}_+$ such that

$$q_2(\tau_2, q_1) = \arg\max_{q_2} [P(q_2 + q_1) - \delta_2 - \tau_2] q_2, \tag{11}$$

and country H, after observing $q_1 \in Q$, sets $\tau_2(q_1)$ to maximize (3). Note that the optimal decision of $q_2(\tau_2, q_1)$ and $\tau_2(q_1)$ depend not on τ_1, but on q_1, which allows us to rewrite the solution of q_2 as a function of q_1, that is, $q_2(\tau_2(q_1), q_1) = q_2(q_1)$. Upon completion of the first agreement, the leader, being offered $\tau_1 \in \mathcal{T}$, chooses $q_0 : \mathcal{T} \to \mathbb{R}_+$ and $q_1 : \mathcal{T} \to \mathbb{R}_+$ to maximize

$$\int_0^{dt} e^{-rs}[P(q_0) - \delta_1 - \tau_1] q_0 ds + \int_{dt}^{\infty} e^{-rs}[P(q_2(q_1) + q_1) - \delta_1 - \tau_1] q_1 ds. \tag{12}$$

The first term implies that the leader realizes the monopolistic profit without q_2, and thereafter plays the Stackelberg leader's strategy. Country H levies $\tau_1 \in \mathcal{T}$ to maximize

$$\int_0^{dt} e^{-rs}\left[\int_0^{q_0(\tau_1)}[P(q)-P(q_0(\tau_1))]dq+\tau_1 q_0(\tau_1)\right]ds+e^{-rdt}DS(\tau_1,\tau_2(q_1(\tau_1))), \quad (13)$$

where DS is described in (3). One may wonder what would happen if country H could adjust the tariff rates on country 1's export goods after country 2 enters the market. If dt is not long enough, all results in this subsection can be applied without any qualitative changes.[9] Through the importing country's optimization, we obtain that

$$\tau_1^{PE}=\frac{1}{9}[(3-e^{-rdt})a-3\delta_1+e^{-rdt}\delta_2] \text{ and } \tau_2^{PE}=\frac{1}{18}[(3-e^{-rdt})a+6\delta_1+(e^{-rdt}-9)\delta_2], \quad (14)$$

where superscript "E" stands for "sequential agreements." Each foreign country, depending on its position, then chooses

$$q_0^{PE}=\frac{1}{18b}[(6+e^{-rdt})a-6\delta_1-e^{-rdt}\delta_2], \quad (15)$$

$$q_1^{PE}=\frac{1}{18b}[(3+e^{-rdt})a-6\delta_1+(3-e^{-rdt})\delta_2], \text{ and } q_2^{PE}=\frac{1}{3b}[a-\delta_2]. \quad (16)$$

In sequential trade agreements, the first exporter is expected to enjoy the first mover's advantage by manipulating the follower's behavior, because the follower will take the leader's decision as given (forward manipulation). However, if the importing country negotiates with the follower after observing the leader's move, it may offer the follower a more favorable condition to encourage the follower's export (backward stealing). Consequently, the follower may export further than the leader, as shown in (16). In the framework of international trade, Bagwell and Staiger (2010) point out for the first time 'forward manipulation vs backward stealing.' Extending their notion of forward manipulation vs backward stealing, this paper shows, in what follows, that the importing country can exploit the MFN clause by a means of commitment device for 'No Backward Stealing' to encourage the leader's export in the sequential trade agreements, which maximizes the importing

[9] More specifically, the leader may build up a larger retail network or hire many employees to manipulate the follower's decision. In the presence of this irreversible and fixed investment, the leader indeed considers the convex combination of present values of its own profits in the monopoly and duopoly markets. Unless the monopoly spell is sufficiently large, the leader puts more weight on its own strategy in the duopoly market. In light of this, we can infer that a different tariff rate during the short monopoly period has a limited effect on the leader's preemptive behavior in qualitative sense.

country's surplus.

If the MFN principle is embedded in the sequence of the bilateral agreements, country H chooses $(\tau_1, \tau_2) \in \mathcal{T} \times \mathcal{T}$ up front to maximize (13) subject to $\tau_1 = \tau_2 = \tau$, and skips the surplus maximization in stage 2. Solving for the sequential game yields

$$q_0^{ME} = (24b + 6be^{-rdt})^{-1}((8 + 4e^{-rdt})a + (-8 - 5e^{-rdt})\delta_1 + e^{-rdt}\delta_2), \tag{17}$$

$$q_1^{ME} = (12b + 3be^{-rdt})^{-1}((4 + 2e^{-rdt})a + (-10 - 4e^{-rdt})\delta_1 + (6 + 2e^{-rdt})\delta_2), \tag{18}$$

$$q_2^{ME} = (12b + 3be^{-rdt})^{-1}((2 + e^{-rdt})a + (7 + e^{-rdt})\delta_1 + (-9 - 2e^{-rdt})\delta_2), \text{ and} \tag{19}$$

$$\tau_1^{ME} = (12 + 3e^{-rdt})^{-1}((4 - e^{-rdt})a + (-4 + 2e^{-rdt})\delta_1 - e^{-rdt})\delta_2 = \tau_2^{ME}. \tag{20}$$

Country H strategically determines the order of the trade agreements before making the first agreement. Proposition 3 prescribes the strategic choice of country H.

Proposition 3 *Under the MFN principle, the importing country strategically makes a trade agreement with the cost-efficient country first. Under the preferential regime, the importing country establishes a trade agreement with the cost-efficient country second when* $e^{-rdt} > 0.903$.

It has been repeatedly reported in the literature on the sequential game that the second contracting party receives a price discount. Herweg and Müller (2012) point out that the monopolistic supplier of intermediate goods grants a price discount to new downstream entrants in vertically related markets, and Kim and Sim (2015), extending Herweg and Müller (2012), show that the monopolistic supplier contracts first with an efficient, and grants a price discount to the other, retailer. In these studies, the price discount increases the sales volume of the monopolist by encouraging participation or production by the follower. In our model, when it is allowed to differentiate its tariff rates, the importing country grants tariff cuts to the follower for the same purpose, but sets the efficient country as the follower to amplify the effect of the tariff cuts, which never occurs in Kim and Sim (2015). When the MFN clause is required, the importing country, because it is not able to differentiate tariff rates, sets the efficient country as the leader and grants it instead first mover advantage.

Proposition 4 *Suppose that* $e^{-rdt} > 0.638$. *When the MFN principle is required, the following inequalities hold.*

(i) $\tau^{MI} > \tau^{ME}$ *when* $e^{-rdt} > 0.734$.

(ii) $q_A^{MI} < q_A^{ME}, q_B^{MI} > q_B^{ME}$, *and* $Q^{MI} < Q^{ME}$.

(iii) $DS^{MI} < DS^{ME}$ *and* $GS^{MI} < GS^{ME}$.

Proposition 4 states that when the MFN principle is required, unless dt is sufficiently long, the importing country prefers to make "sequential bilateral trade agreements" rather than a "one shot multilateral trade agreement." In sequential agreements that embed the MFN principle, the importing country gives the efficient country the first mover advantage and at the same time commits to protect the efficient country's business from potential backward stealing by the follower, which encourages the efficient leader to export, but discourages the inefficient follower from exporting. Sequential bilateral agreements that grant the efficient country the opportunity for forward manipulation improve both the domestic and global surpluses. In particular, since $q_A^{MI} < q_A^{ME}$ and $q_B^{MI} > q_B^{ME}$, the average production cost per unit is smaller in "sequential bilateral trade agreements" than in a "one shot multilateral trade agreement," but total imports are larger in the former than the latter. Apparently, the global trade surplus is higher in the former.

Proposition 5 *Suppose that* $e^{-rdt} > 0.903$. *In the absence of the MFN clause, the following inequalities hold.*
(*i*) $\tau_A^{PI} > \tau_A^{PE}$ *when* $\tau_B^{PI} > \tau_B^{PE}$.
(*ii*) $q_A^{PI} < q_A^{PE}, q_B^{PI} > q_B^{PE}$, *and* $Q^{PI} < Q^{PE}$.
(*iii*) $DS^{PI} > DS^{PE}$ *but* $GS^{PI} < GS^{PE}$.

According to Proposition 5, when Article XXIV of GATT and Article V of GATS permit deviation from the MFN principle, the importing country, as long as dt is sufficiently short, prefers a "one shot multilateral trade agreement" to "sequential bilateral trade agreements." Proposition 3 shows the importing country, in the absence of the MFN principle, to optimally grant the efficient country the opportunity for backward stealing. When the importing country imposes high tariffs on both the inefficient leader and efficient follower, the total volume of goods from both countries increases, but the domestic surplus of the importing country declines. When the importing country switches from the strategy of the one shot multilateral agreement to that of sequential bilateral agreements, because the efficient country is granted a tariff discount, the global surplus improves. It is also straightforward by the same reasoning as in Proposition 4.

The equilibrium outcome in the sequential setting depends on dt, the time interval between two trade agreements. Apparently, the importing country wants to minimize this interval whenever possible. When $dt \to 0$, the importing country determines the tariff rates such that

$$\tau_1^{PE} = \frac{1}{9}[2a - 3\delta_1 + \delta_2] \text{ and } \tau_2^{PE} = \frac{1}{9}[a + 3\delta_1 - 4\delta_2]. \tag{21}$$

The equilibrium trade volume is respectively given by

$$q_1^{PE} = \frac{1}{9b}[2a - 3\delta_1 + \delta_2] \text{ and } q_2^{PE} = \frac{1}{3b}[a - \delta_2]. \tag{22}$$

Under the MFN, the equilibrium outcome is given by

$$q_1^{ME} = \frac{1}{15b}[6a - 14\delta_1 + 8\delta_2], \; q_2^{ME} = \frac{1}{15b}[3a + 8\delta_1 - 11\delta_2], \text{ and} \tag{23}$$

$$\tau_1^{ME} = \frac{1}{15}[3a - 2\delta_1 - \delta_2] = \tau_2^{ME}. \tag{24}$$

Note that the equilibrium outcome, independent of whether MFN is embedded, will not converge to the outcome of the one shot multilateral trade agreement. In case of sequential bilateral trade agreements, regardless of dt, the importing country attempts to exploit the foreign countries' interdependent export decisions by manipulating their information sets. Unlike the preferential principle, under which the equilibrium outcome differs across regimes, multiple bilateral agreements that embed the MFN principle provide a strong commitment device.

III. The MFN Principle as a Commitment Device

A natural extension of the foregoing analysis is to examine whether individual countries that engage in sequential bilateral trade agreements by invoking Article XXIV of GATT and Article V of GATS adopt the MFN clause. More specifically, we investigates why the MFN clause is often embedded in RTAs.[10] For simplicity, we send dt to zero. But the result in this section is applied to the cases where dt is not so large.

Proposition 6 *Suppose that the importing country sequentially establishes multiple bilateral trade agreements.*

(i) $\min\{\tau_B^{PE}, \tau^{ME}\} > \tau_A^{PE}$. *In particular,* $\tau_B^{PE} \geq \tau^{ME}$ *if and only if* $a \geq 12\delta_B - 11\delta_A$.

(ii) $q_A^{ME} > q_A^{PE}, q_B^{ME} < q_B^{PE}$, *and* $Q^{ME} > Q^{PE}$.

(iii) $DS^{ME} > DS^{PE}$ *and* $GS^{ME} > GS^{PE}$.

Interestingly, the preferential regime, although it imposes a higher tariff rate on

[10] RTAs like the South Korea-U.S. free trade agreement, although they may deviate from the MFN principle, by invoking Article XXIV of GATT and Article V of GATS, embed the MFN clause in bilateralism.

the efficient country in a one shot multilateral agreement, sets that country as the follower and gives it a tariff cut in sequential bilateral agreements. As a result, country A produces and pays less under the preferential principle than under the MFN principle, which makes the importing country strictly prefers ME to PE. That country H voluntarily wants to embed the MFN clause is an interesting reversion to Proposition 1. Apparently, although the MFN clause restricts welfare-maximization by country H in the simultaneous game, in the case of sequential trade agreements, it gives the importing country a commitment device which encourages exports by the efficient country such that total exports, consumer surplus, and tariff revenue increase together. Since $Q^{ME} > Q^{PE}, q_A^{ME} > q_A^{PE}$, and $q_B^{ME} < q_B^{PE}$, the global trade surplus also increases under the MFN principle.

To see this more clearly, consider the hypothetical case in which country H commits to the leader up front the tariff rate it will impose on the follower's exports. Country H will not change the tariff rates following the leader's decision. Designate by overhead ^ all variables and mappings associated with the Stackelburg game. Given $(\hat{\tau}_A, \hat{\tau}_B)$, the outcome of stage 2 is similar to the outcomes of the previous cases. In stage 1, the domestic government chooses $(\hat{\tau}_1, \hat{\tau}_2)$ to maximize (3), which results in

$$\hat{\tau}_1^{PE} = \frac{1}{10}[2a - 3\delta_1 + \delta_2] \text{ and } \hat{\tau}_2^{PE} = \frac{1}{10}[2a + 2\delta_1 - 4\delta_2]. \tag{25}$$

The importing country then establishes a trade agreement with the efficient country first. Taking the sequence of the trade agreements and tariff rates as given, the exporting countries determine $(\hat{q}_1^{PE}, \hat{q}_2^{PE})$ such that

$$\hat{q}_1^{PE} = \frac{1}{5b}[2a - 3\delta_1 + \delta_2], \text{ and } \hat{q}_2^{PE} = \frac{1}{5b}[a + \delta_1 - 2\delta_2]. \tag{26}$$

Proposition 7 *Suppose that the importing country sequentially establishes a separate bilateral trade agreement with each country, and can commit both tariff rates up front.*
(*i*) *The importing country establishes a trade agreement with the efficient country first.*
(*ii*) $\hat{\tau}_A^{PE} > \tau^{ME} > \hat{\tau}_B^{PE}$.
(*iii*) $Q^{ME} = \hat{Q}^{PE}$.
(*iv*) $DS^{ME} < \widehat{DS}^{PE}$ *and* $GS^{ME} > \widehat{GS}^{PE}$.

Proposition 7 argues that reversal of the welfare implication in Proposition 6, which results from the importing country being afforded a commitment device by the MFN, but not by the preferential principle, is corrected when country H is allowed to make such a commitment. When the importing country can *commit* different tariff rates under the preferential regime, it imposes a higher tariff on the efficient country than the other country as in the previous simultaneous game. Therefore, we obtain the same welfare implication as in the previous literature.

Proposition 8 *Suppose that the importing country can freely adjust the time interval between two different agreements, and also can embed or remove the MFN clause. Then, the import country prefers the sequential agreement with the MFN clause to the other modes. The global surplus is maximized as well, when the import country implements the sequential agreements with the MFN clause.*

When the importing country can freely choose the time interval, it will choose sufficiently small but positive dt (i.e. $dt \to 0$), because

$$DS^{ME} = \frac{1}{30b}[3a - 2\delta_A - \delta_B]^2 > \frac{1}{16b}[2a - \delta_A - \delta_B]^2 = DS^{PI}, \tag{27}$$

under Assumption 2. Also, $GS^{ME} > GS^{MI}$ in Proposition 4, and $GS^{ME} > GS^{PE} > GS^{PI}$ in Proposition 5 and 6. Consequently, Proposition 4-7 jointly conclude that the MFN principle can be utilized as a commitment device, and, when it is, it may improve the domestic surplus of the importing country as well as production efficiency of the world economy.

IV. Conclusion

Taking into account simultaneity/sequentiality enables us to reexamine the welfare implication of the MFN principle in the previous literature and extend its applicability to the recently observed pervasive phenomenon of RTAs. We shed light on the role of the MFN principle as a “no backward stealing” commitment in sequential bilateral agreements. When the importing country strategically determines the sequence of the agreement partners as well as the origin-specific tariff rates, voluntarily embedding the MFN clause into the first agreement with a cost-efficient country both benefits the importing country and improves the global trade surplus. A clue to accounting for the coexistence of the MFN principle and Article XXIV of GATT (and Article V of GATS) in the era of RTA proliferation is that more trade surplus accrues to the importing country under the MFN principle than the preferential principle, especially when the importing country establishes multiple bilateral agreements sequentially. This prediction is consistent with Miroudot, Sauvage, and Sudreau (2010) reporting that 79 percent of regional trade agreements contain the MFN provisions and majority of them grant each party of the RTA more favorable treatments in subsequent RTAs by its partner.

Given the recent prevailing trend of Free Trade Agreements (FTAs), one may wonder whether our approach is still valid in the case of FTAs with zero tariff rates. Our conclusion on the role of the MFN clause in sequential agreements is not immediately applicable to the case with zero tariff rates, because the importing country in our model considers tariff revenue as well as consumer surplus. As long as the importing country imposes the zero tariff on one exporter among multiple asymmetric countries as an equilibrium outcome, i.e. by introducing bilateral bargaining, our main argument, “the MFN clause can be exploited as a means of commitment for no backward stealing,” is expected to be still valid. We leave it for future extension.

We demonstrate that the MFN principle may, but acknowledge that it will not necessarily always, improve the trade surplus of the importing country as well as the global surplus. One shortcoming of the present research is that, our focus on the role of the MFN clause leading us to apply the rule of “the more, the better” to importing goods, it neglects the import-competing sectors of the importing country. It further ignores the weight parameter of the quasi-linear preference, according equal treatment to consumer surplus and tariff revenue. We leave it for future quantitative research to determine whether these shortcomings have led us to overvalue the positive impact of the MFN clause.

Appendices

A. Mathematical Proofs

Proof of Proposition 1 (*i*) From equations in (5) and (6), we obtain that

$$\tau_A^{PI} = \frac{1}{8}[2a - 3\delta_A + \delta_B] \geq \tau^{MI} = \frac{1}{8}[2a - \delta_A - \delta_B] \geq \tau_B^{PI} = \frac{1}{8}[2a + \delta_A - 3\delta_B], \quad \text{(A1)}$$

where inequalities follow from $\delta_A \leq \delta_B$.
(*ii*) By the same reasoning above, we obtain that

$$q_A^{MI} = \frac{1}{8b}[2a - 5\delta_A + 3\delta_B] \geq \frac{1}{8b}[2a - 3\delta_A + \delta_B] = q_A^{PI}, \text{ and} \quad \text{(A2)}$$

$$q_B^{MI} = \frac{1}{8b}[2a + 3\delta_A - 5\delta_B] \leq \frac{1}{8b}[2a + \delta_A - 3\delta_B] = q_B^{PI}. \quad \text{(A3)}$$

(*iii*) Since $CS = b(q_A + q_B)^2 / 2$, we obtain that $CS^{MI} = CS^{PI}$ from (*ii*). That $TR = \Sigma_i q_i \tau_i$ implies

$$TR^{PI} = \frac{2}{64b}[2a - \delta_A - \delta_B]^2 + \frac{1}{8b}(\delta_A^2 - 2\delta_A\delta_B + \delta_B^2) = TR^{MI} + \frac{1}{8b}(\delta_B - \delta_A)^2. \text{(A4)}$$

Therefore, it is straightforward that $DS^{MI} \leq DS^{PI}$. For global surplus, we need to consider the present value of each firm's profit.

$$(\pi_A^{MI} + \pi_B^{MI}) - (\pi_A^{PI} + \pi_B^{PI}) = (\pi_A^{MI} - \pi_A^{PI}) + (\pi_B^{MI} - \pi_B^{PI}) \quad \text{(A5)}$$
$$= \frac{1}{8br}(a - 2\delta_A + \delta_B)(\delta_B - \delta_A) - \frac{1}{8br}(a + \delta_A - 2\delta_B)(\delta_B - \delta_A) = \frac{24}{64br}(\delta_B - \delta_A)^2 \geq 0.$$

Then global surplus difference is

$$GS^{MI} - GS^{PI} = -\frac{1}{8br}(\delta_B - \delta_A)^2 + \frac{24}{64br}(\delta_B - \delta_A)^2 = \frac{1}{4br}(-\delta_A + \delta_B)^2 \geq 0. \quad \text{(A6)}$$

In all cases, the strict equality holds when $\delta_A = \delta_B$.

Proof of Proposition 2 (*i*) The detailed derivations for $(q_A^{MI}, q_B^{MI}, \tilde{q}_A^{PI}, \tilde{q}_B^{PI})$ and $(\tau^{MI}, \tilde{\tau}_A^{PI}, \tilde{\tau}_B^{PI})$ are presented in a separate online appendix. Given $(\tau^{MI}, \tilde{\tau}_A^{PI}, \tilde{\tau}_B^{PI})$, we obtain that

$$\tau^{MI} - \tilde{\tau}_i^{PI} = \frac{1}{8}[2a - \delta_i - \delta_{i'}] - \frac{1}{3}[\delta_{i'} - \delta_i] = \frac{1}{24}[6a + 5\delta_i - 11\delta_{i'}] > 0 , \tag{A7}$$

for any $i \in \{A, B\}$.
(*ii*) Given $(q_A^{MI}, q_B^{MI}, \tilde{q}_A^{PI}, \tilde{q}_B^{PI})$, we obtain that

$$q_A^{MI} + q_B^{MI} = \frac{1}{4b}[2a - \delta_A - \delta_B] < \frac{1}{3b}[2a - \delta_A - \delta_B] = \tilde{q}_A^{PI} + q_B^{PI} . \tag{A8}$$

(*iii*) Since

$$DS^{MI} = \frac{1}{r}[CS^{MI} + TR^{MI}] = \frac{1}{16br}[2a - \delta_A - \delta_B]^2 \quad \text{and} \tag{A9}$$

$$\widetilde{DS}^{PI} = \frac{1}{r}[\widetilde{CS}^{PI} + \widetilde{TR}^{PI}] = \frac{1}{18br}[2a - \delta_A - \delta_B]^2 + \frac{1}{9br}[\delta_B - \delta_A]^2 , \tag{A10}$$

we obtain that

$$DS^{MI} - \widetilde{DS}^{PI} = \frac{1}{144br}[2a + 3\delta_A - 5\delta_B][2a - 5\delta_A + 3\delta_B] \geq 0 . \tag{A11}$$

The last inequality follows from Assumption 1.

Proof of Proposition 3 The detailed derivations for $(q_A^{ME}, q_B^{ME}, q_A^{PE}, q_B^{PE})$ and $(\tau^{ME}, \tau_A^{PE}, \tau_B^{PE})$ are presented in a separate online appendix. Let $X := a - \delta_A$ and $Y := \delta_B - \delta_A$. Denote by $DS_A^{PE}(DS_B^{PE})$ the domestic surplus of the importing country when country A (country B) becomes the leader. When country A becomes the leader under the MFN principle, the domestic surplus is given by

$$\begin{aligned} DS_A^{ME} &= (24b(4 + e^{-rdt}))^{-1}(4(2 + e^{-rdt})^2 X^2 - 4(5 + e^{-rdt})e^{-rdt} XY \\ &\quad + (3 + e^{-rdt})e^{-rdt} Y^2) . \end{aligned} \tag{A12}$$

When country B becomes the leader, the domestic surplus is given by

$$DS_B^{ME} = DS_A^{ME} + 4(24b(4 + e^{-rdt}))^{-1}((2e^{-rdt} - 8)XY + (-e^{-rdt} + 4)Y^2) < DS_A^{ME} . \tag{A13}$$

The last inequality follows from Assumption 2 and $0 < e^{-rdt} < 1$. Hence country A is set as the leader under the MFN principle.

When country A is the leader under the preferential regime, the domestic surplus is given by

$$DS_A^{PE} = \frac{1}{216b}[(e^{-2rdt} + 15e^{-rdt} + 36)X^2 - e^{-rdt}(2e^{-rdt} + 54)XY$$
$$+(e^{-2rdt} + 39e^{-rdt})Y^2]. \tag{A14}$$

When country *B* is set as the leader, the domestic surplus is given by

$$DS_B^{PE} = DS_A^{PE} + \frac{1}{216b}(-2XY + Y^2)(-e^{-2rdt} - 39e^{-rdt} + 36) > DS_A^{PE}. \tag{A15}$$

$-2XY + Y^2$ is negative under Assumption 2 and $-e^{-2rdt} - 39e^{-rdt} + 36$ is negative when $e^{-rdt} > 0.903$. Therefore the last inequality holds when $e^{-rdt} > 0.903$. Finally, country *B* will be chosen as the leader.

Proof of Proposition 4 (*i*) Let $X := a - \delta_A$ and $Y := \delta_B - \delta_A$. The difference of the two tariff rates is

$$\tau^{MI} > \tau^{ME} \Leftrightarrow (14e^{-rdt} - 8)X > (12 - 5e^{-rdt})Y. \tag{A16}$$

The strict inequality is satisfied under Assumption 2 when $e^{-rdt} > 0.734$.
(*ii*) Similarly, we obtain that

$$q_A^{MI} < q_A^{ME} \Leftrightarrow (20e^{-rdt} + 16)X > (-24 - 14e^{-rdt})Y \quad \text{and} \tag{A17}$$
$$q_B^{MI} > q_B^{ME} \Leftrightarrow (-4e^{-rdt} + 16)X > (-24 - 2e^{-rdt})Y, \tag{A18}$$

when $e^{-rdt} > 0.638$. Connecting (A17) and (A18) yields

$$q_A^{MI} - q_A^{ME} + q_B^{MI} - q_B^{ME} = (12b + 3be^{-rdt})^{-1}(-24e^{-rdt}X - 12e^{-rdt}Y) < 0. \tag{A19}$$

(*iii*) The global surplus depends on total consumption by the domestic consumers and production cost of the foreign countries. Conditions (A17), (A18) and (A19) predicts the average cost per unit to be smaller in *ME* than in *MI*. Also, total consumption increases. Hence, global surplus increases as well. As for domestic surplus, subtracting DS^{MI} from DS^{ME} and multiplying by $(48b(4 + e^{-rdt}))$ yields

$$48b(4 + e^{-rdt})(DS^{ME} - DS^{MI}) = e^{-2rdt}(8X^2 - 8XY + 2Y^2)$$
$$+e^{-rdt}(20X^2 - 28XY + 3Y^2) + (-16X^2 + 48XY - 12Y^2), \tag{A20}$$

where $(8X^2 - 8XY + 2Y^2) \geq 0$. Since e^{-rdt} is between 0 and 1, it is sufficient to check the sign of the right hand side within the interval. When $e^{-rdt} \to 0$, the right hand side of (A20) has a negative value under assumption 2. When $e^{-rdt} = 1$, it has a positive value. Since it is strictly increasing for any $e^{-rdt} \in (0,1]$, Intermediate Value Theorem provides a unique solution of the quadratic equation of (A20) at $e^{-rdt} \approx 0.638$. Therefore, $e^{-rdt} > 0.638, DS^{ME} > DS^{MI}$.

Proof of Proposition 5 (*i*) Let $X := a - \delta_A$ and $Y := \delta_B - \delta_A$. Then,

$$\tau_A^{PI} > \tau_A^{PE} \Leftrightarrow (6 + 4e^{-rdt})X > 15Y \text{ and } \tau_B^{PI} > \tau_B^{PE} \Leftrightarrow (8e^{-rdt} - 6)X > 3Y. \quad \text{(A21)}$$

The inequalities are satisfied under Assumption 2 when $e^{-rdt} > 0.903$.
(*ii*) Similarly, we obtain that

$$q_A^{PI} < q_A^{PE} \Leftrightarrow 2X > 3Y \text{ and } q_B^{PI} > q_B^{PE} \Leftrightarrow (6 - 4e^{-rdt})X > 3Y, \quad \text{(A22)}$$

when $e^{-rdt} > 0.638$. Connecting those inequalities in (A22) and applying Assumption 2 yields

$$q_A^{PI} - q_A^{PE} + q_B^{PI} - q_B^{PE} = \frac{1}{36b}(-2e^{-rdt}X + 3Y) < 0, \quad \text{(A23)}$$

when $e^{-rdt} > 0.903$.
(*iii*) By the same reasoning as in the proof of Proposition 4, the global surplus increases. Subtracting DS^{PE} from DS^{PI} and multiplying by 432*b* yields

$$\begin{aligned} 423b(DS^{PI} - DS^{PE}) = {} & e^{-2rdt}(-2X^2) + e^{-rdt}(-30XY - 48Y^2) \\ & + (36X^2 + 36XY + 9Y^2). \end{aligned} \quad \text{(A24)}$$

This value decreases as *dt* approaches to zero. When $dt = 0, e^{-rdt} = 1$ and the right hand side of (A24) is $(2X - 3Y)^2 > 0$ under Assumption 2. Therefore $DS^{PI} > DS^{PE}$.

Proof of Proposition 6 (*i*) Proposition 3 argues that the importing country makes a trade agreement with country *A* first under the MFN regime and country *B* under the preferential regime. It implies that

$$\tau_B^{PE} - \tau_A^{PE} = \frac{1}{9}[a + 5\delta_A - 6\delta_B] > 0, \ \tau^{ME} - \tau_A^{PE} = \frac{1}{45}[4a + 14\delta_A - 18\delta_B] > 0, \text{ and}$$

$$\tau^{ME} - \tau_B^{PE} = \frac{1}{45}[-a - 11\delta_A + 12\delta_B] < 0. \quad \text{(A25)}$$

(*ii*) By similar reasoning, it implies that

$$q_A^{ME} - q_A^{PE} = \frac{1}{15b}[a - 9\delta_A + 8\delta_B] \geq \frac{1}{15b}\left[\frac{11}{3}\delta_B - \frac{8}{3}\delta_A - 9\delta_A + 8\delta_B\right]$$
$$= \frac{7}{9b}[\delta_B - \delta_A] \geq 0\,. \qquad \text{(A26)}$$

The second and last inequality follow from Assumption 2 and $\delta_B \geq \delta_A$, respectively. By the same reasoning, it is obtained that

$$q_B^{ME} - q_B^{PE} = \frac{1}{45b}[-a + 19\delta_A - 18\delta_B] \leq \frac{1}{45b}\left[-\frac{11}{3}\delta_B + \frac{8}{3}\delta_A + 19\delta_A - 18\delta_B\right] \leq 0\,. \text{(A27)}$$

Summing up (A26) and (A27) yields

$$q_A^{ME} - q_A^{PE} + q_B^{ME} - q_B^{PE} = \frac{2}{45b}[a - 4\delta_A + 3\delta_B] = \frac{40}{135b}[\delta_B - \delta_A] \geq 0\,. \qquad \text{(A28)}$$

(*ii*) From equation (A28), $CS^{ME} > CS^{PE}$. Let $X := a - \delta_A$ and $Y := \delta_B - \delta_A$. Then, under Assumption 2, $X > 0, Y \geq 0$, and $X - 3Y = a + 2\delta_A - 3\delta_B > 0$. Using X and Y, we can rewrite tariff revenue as follows.

$$TR^{ME} = \frac{1}{75b}[3a - 2\delta_A - \delta_B]^2 = \frac{1}{75b}(3X - Y)^2\text{, and} \qquad \text{(A29)}$$

$$TR^{PE} = \frac{1}{81b}[2a + \delta_A - 3\delta_B]^2 + \frac{1}{27b}[a - 4\delta_A + 3\delta_B][a - \delta_A]$$
$$= \frac{1}{81b}[7X^2 - 3XY + 9Y^2]. \qquad \text{(A30)}$$

If $\delta_A = \delta_B$, it's trivial that $Y = 0$, $TR^{ME} > TR^{PE}$, and $CS^{ME} > CS^{PE}$. Otherwise, $Y > 0$. Subtracting (A30) from (A29) yields

$$TR^{ME} - TR^{PE} = \frac{Y^2}{2025b}\left[68\left(\frac{X}{Y}\right)^2 - 87\left(\frac{X}{Y}\right) - 198\right]. \qquad \text{(A31)}$$

Note that equation (A31) is strictly positive for any $X/Y \in [3, \infty)$. Therefore, $TR^{ME} > TR^{PE}$ and $DS^{ME} > DS^{PE}$. Using X and Y, we also rewrites trade surplus given to foreign countries. As a result,

$$GS^{ME} = \frac{1}{150br}[63X^2 - 42XY + 107Y^2]\text{, and}$$

$$GS^{PE} = \frac{1}{162br}[65X^2 - 60XY + 45Y^2]. \tag{A32}$$

Finally, $GS^{ME} - GS^{PE} = (38X^2 + 183XY + 882Y^2)/(2025br) > 0$.

Proof of Proposition 7 (*i*) Denote by $\widehat{CS}_i^{PE}$ and $\widehat{TR}_i^{PE}$ the consumer surplus and tariff revenue when country $i \in \{A, B\}$ is the leader under the preferential regime with commitment. Then,

$$\widehat{CS}_A^{PE} - \widehat{CS}_B^{PE} = \frac{1}{50b}[6a - 3\delta_A - 3\delta_B][\delta_B - \delta_A] \geq 0 \text{, and} \tag{A33}$$

$$\widehat{TR}_A^{PE} - \widehat{TR}_B^{PE} = \frac{1}{50b}[4a - 2\delta_A - 2\delta_B][\delta_B - \delta_A] \geq 0. \tag{A34}$$

Therefore, the importing country wants to make a trade agreement with country A first.

(*ii*) The importing country makes a trade agreement with country A first under the MFN regime as well as under the preferential regime with commitment. Then,

$$\hat{\tau}_A^{PE} = \frac{1}{5}\left[a - \frac{3\delta_A}{2} + \frac{\delta_B}{2}\right] > \tau^{ME} = \frac{1}{5}\left[a - \frac{2\delta_A}{3} - \frac{\delta_B}{3}\right] > \hat{\tau}_B^{PE} = \frac{1}{5}[a - \delta_A - 2\delta_B]. \tag{A35}$$

(*iii*) By the same reasoning,

$$q_A^{ME} + q_B^{ME} = \frac{1}{5b}[3a - 2\delta_A - \delta_B] = \hat{q}_A^{PE} + \hat{q}_B^{PE}. \tag{A36}$$

(*iv*) Since $CS^{ME} = \widehat{CS}^{PE}$, it is sufficient to compare TR^{ME} and $\widehat{TR}^{PE}$. Let $X := a - \delta_A$ and $Y := \delta_B - \delta_A$.

$$TR^{ME} - \widehat{TR}^{PE} = \frac{1}{150b}(18X^2 - 12XY + 2Y^2) - \frac{1}{150b}(18X^2 - 12XY + 27Y^2) < 0. \tag{A37}$$

Therefore, $\widehat{DS}^{PE} > DS^{ME}$. To compare global surplus, we need to compare profits first. Then,

$$\pi_A^{ME} + \pi_B^{ME} = \frac{1}{150rb}(18X^2 - 12XY + 102Y^2), \tag{A38}$$

$$\hat{\pi}_A^{PE} + \hat{\pi}_B^{PE} = \frac{1}{150rb}(18X^2 - 12XY + 27Y^2) \text{, and} \tag{A39}$$

$$GS^{ME} - \widehat{GS}^{PE} = \frac{1}{r}(TR^{ME} - \widehat{TR}^{PE}) + \pi_A^{ME} + \pi_B^{ME} - \hat{\pi}_A^{PE} + \hat{\pi}_B^{PE} = \frac{50Y^2}{150b} > 0. \tag{A40}$$

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