Multilateral trade negotiations, bilateral opportunism and the rules of GATT/WTO

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Abstract

Trade negotiations occur through time and between the governments of many countries. An important issue is thus whether the value of concessions that a government wins in a current negotiation may be eroded in a future bilateral negotiation to which it is not party. We identify rules of negotiation that serve to protect the welfare of governments that are not participating in the bilateral negotiation. Our main finding is that the two central principles of GATT/WTOnondiscrimination (MFN) and reciprocitypreserve the welfare of nonparticipating governments and therefore offer a first-line of defense against bilateral opportunism.

Keywords: Nondiscrimination; Reciprocity; Bilateral opportunism; Trade agreements

1. Introduction

For over 50 years, GATT and now the WTO have successfully encouraged multilateral trade liberalization. This liberalization has been accomplished through a series of agreements negotiated among the member countries, and an important role of the GATT/WTO has been to provide a continuous negotiating forum for this purpose. Each of these agreements amounts to a web of bilateral reciprocal exchanges of market access

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concessions between negotiating governments, secured by commitments to reduce tariffs and other trade barriers, and multilateralized by the most-favored-nation (MFN) rule, which requires that each member offer to every other member access to its markets on nondiscriminatory terms.

The liberalization that has been achieved through GATT/WTO negotiations is especially noteworthy in light of the fact that negotiations occur through time between the governments of various countries. This feature raises the possibility that the market access implied by existing tariff commitments may be altered by tariff commitments made at some point in the future. A particular concern is that the value of concessions that a government wins today may be eroded in a future bilateral negotiation to which it is not party. Taking the argument a step further, if governments recognize that current market access relations may be vulnerable to opportunistic bilateral agreements in the future, then they may exchange concessions with trepidation. A multilateral trade organization like the GATT/WTO is thus more likely to achieve its objectives, if it includes rules of negotiation that serve to protect the value of previous concessions won by governments that are not participating in current bilateral negotiations.

It is therefore important to ask: how effective are the GATT/WTO principles that govern bilateral negotiations in protecting the welfare of nonparticipating governments? In this paper, we present a modeling framework within which to address this question, and we focus on three key GATT/WTO principles: nondiscrimination, reciprocity and "nullification or impairment".

The principle of nondiscrimination is a first pillar of the GATT/WTO architecture. This principle requires that tariff reductions achieved through a bilateral agreement are extended on an MFN basis to nonparticipants. Schwartz and Sykes (1997) argue that the main benefit of the MFN rule is that it protects the value of concessions:

> *"More important, the MFN obligation protects the value of concessions against future erosion through discrimination. If country A receives a concession from country B and is not entitled to MFN treatment from B, then the value of the concession can be undermined if country B later makes an even better concession to country C on the same goods (or close substitutes). Faced with this uncertainty, country A would offer less for the concession in the first place (as would country B for the reciprocal concession), and fewer valuable deals would be struck."* (p. 62)

While the MFN rule can clearly offer protection of this kind, it remains to determine formally whether this rule fully eliminates the opportunism problem.

The second pillar of the GATT/WTO architecture is the principle of reciprocity. Under this principle, negotiations result in tariff adjustments that generate for each participant an equal change in the volume of its imports and exports.[1] This principle is

[1] The principle of reciprocity is represented in GATT/WTO practice in two ways. First, it is often associated with the broad manner in which government negotiators approach trade-policy negotiations. Second, it appears in GATT articles (e.g., GATT Article XXVIII) as a means of determining the compensation that may be sought when a trading partner modifies or withdraws a previous concession. For further discussion, see Bagwell and Staiger (2002).

often denounced as reflecting unsound mercantilist reasoning. But in fact it can promote efficient trade agreements, as it serves to fix the world price between negotiating partners, so that neither partner experiences a terms-of-trade loss when tariffs are reciprocally liberalized.

The third rule that warrants attention here is the nullification-or-impairment rule. GATT Dispute Panels have consistently recognized that the value of a tariff concession is the improved market access which it represents. Accordingly, when a government takes some action that nullifies or impairs a previous concession made to some trading partner, that partner has a potentially legitimate basis from which to file a complaint, even if no violation of GATT/WTO rules is alleged. As Petersmann (1997) details, these complaints are handled under GATT Article XXIII, and the three conditions established by dispute panels for a successful nonviolation complaint of this kind are that: (1) a reciprocal concession was negotiated between two trading partners; (2) a subsequent action was taken by one government, which, though consistent with GATT articles, adversely affected the market access afforded to its trading partner; and (3) this action could not have been reasonably anticipated by this partner at the time of the negotiation of the original tariff concession. There are a variety of actions that have instigated complaints, including domestic subsidies, product reclassifications, changing regulatory regimes and bilateral trade negotiations with other partners. We focus on the latter possibility here.[2]

To assess the extent to which these rules prevent opportunistic bilateral agreements, we develop a general-equilibrium modeling framework in which a home country exports one good to two foreign countries in exchange for imports from them of a second good. We represent the objectives of each government as a general function of its local prices and terms of trade. This representation is very general, including both the traditional approach in which governments maximize national income and recent political-economy formulations in which governments are also sensitive to distributional issues, and it also clarifies the channel through which one governments tariff choices impose an externality on another governments welfare.

We present our analysis of the featured GATT/WTO rules in three steps. First, we consider whether the principles of reciprocity and nondiscrimination ensure the preservation of the welfare of a nonparticipating government. Beginning with a theoretical perspective, we establish that the welfare of the nonparticipating government is preserved if its countrys terms of trade (equivalently, export and import volumes) are unaltered. This finding extends the logic of the well-known Kemp and Wan (1976) theorem to settings with politically motivated governments that construct bilateral (but not necessarily free-trade) agreements. Next, we show that neither reciprocity nor nondiscrimination is sufficient, on its own, to preserve the welfare of the nonparticipating government. As our main finding, however, we show that the welfare of the

[2] Examples of bilateral agreements that have led to nonviolation nullification-or-impairment complaints are (i). the US complaint regarding tariff preferences negotiated by the EC on citrus products from certain Mediterranean countries, and (ii). the EC complaint regarding aspects of the bilateral agreement between the US and Japan concerning trade in semiconductor products.

nonparticipating government is preserved, when a bilateral agreement must honor reciprocity *and* nondiscrimination. Intuitively, reciprocity ensures that the terms of trade are fixed between the participating governments, and under nondiscrimination this implies in turn that the nonparticipants terms of trade are also preserved.

Having shown that the rigid application of reciprocity and MFN is sufficient to preclude opportunistic bilateral agreements, we may still ask: Are these rules really necessary? Put differently, if there were weaker, or even no, rules that governed bilateral negotiations, so that nonparticipant welfare could be altered, would there exist a permitted bilateral agreement that resulted in lower welfare for the nonparticipating government *and* higher welfare for each participating government? The examination of this issue is the second step of our analysis.

To begin, we suppose that bilateral negotiations are conducted in the absence of rules. We illustrate that the potential for bilateral opportunism is then pervasive: starting from any initial set of efficient tariffs, and holding fixed the tariff policy of foreign country *j*, the home country and foreign country *i* can always find a way to negotiate further changes in their tariffs on each others imports which benefit them at the expense of country *j*. In this sense, when rules are absent, *every* efficient tariff vector is vulnerable to bilateral opportunism.

We show next that a significant set of efficient tariffs remains vulnerable to bilateral opportunism, when the reciprocity rule or the MFN rule is individually imposed. The potential for bilateral opportunism under the MFN rule is of special interest. As we show, for a wide range of initial MFN-efficient tariffs, the home country and foreign country *i* can find a way to negotiate further changes in their tariffs on each others exports which benefit them at the expense of foreign country *j*—even when the home-country tariff cut is extended under the MFN rule to the nonparticipating foreign country *j*. Intuitively, the tariff reduction given by foreign country *i* raises the cost of home exports in foreign country *j*, and this negative effect may overwhelm the beneficial effect of a reduced home tariff on exports from foreign country *j*. With the second step of our analysis, we thus confirm that, while reciprocity and nondiscrimination can together solve the bilateral opportunism problem, neither alone will suffice.

Finally, while we model MFN and reciprocity as formal and rigid rules, their application in GATT/WTO practice is more qualified. This brings us to the third step of our analysis: we consider whether the nullification-or-impairment rule might provide a separate defense against bilateral opportunism. To this end, we propose a definition of market access and show that this is the case: starting from an efficient set of tariffs, any bilateral agreement that is attractive to the home country and foreign country *i* would violate the nullification-or-impairment rule. We therefore provide a formal basis from which to interpret the nullification-or-impairment rule as playing a potentially important role in solving the bilateral opportunism problem. But the nullification-or-impairment rule would by itself be a cumbersome solution to a (pervasive) problem. We thus propose that MFN and reciprocity be understood in GATT/WTO practice as providing a first line of defense against the problem of bilateral opportunism, thereby reducing the number of valid nonviolation complaints and easing the judicial burden of the GATT/WTO dispute settlement procedures. The ability of governments to bring nonviolation nullification-or-violation complaints then serves an important role as a second line of defense against this problem.

This paper builds on our previous work. In Bagwell and Staiger (1999a, 2001a), we represent each governments objective as a general function of its local prices and terms of trade, and we establish that the principles of nondiscrimination and reciprocity can promote efficient trade agreements, by neutralizing the terms-of-trade implications of trade-policy changes.[3] In Bagwell and Staiger (2001b), we extend the framework to include labor and environmental standards, and we analyze the extent to which the nullification-or-impairment rule guards against a regulatory race-to-the-bottom. The innovation of the present paper is that we introduce and study the bilateral opportunism problem. As discussed above, the analysis of this problem generates several new results not present in our earlier work: nondiscrimination and reciprocity together eliminate the potential for bilateral opportunism; neither principle alone is sufficient for this purpose; and the nullification-or-impairment rule provides an additional shield.[4]

The paper proceeds as follows. Section 2 presents the basic model. Section 3 contains the welfare-preservation findings. Section 4 characterizes efficient tariffs in discriminatory environments, identifies in the no-rules case a severe bilateral opportunism problem, and shows that reciprocity alone does not provide a general solution to this problem. Section 5 considers an MFN environment and confirms that the problem of bilateral opportunism remains. Section 6 shows that the nullification-or-impairment rule can provide a separate defense against the bilateral opportunism problem. Section 7 concludes.

2. The model

In this section, we describe a two-good general-equilibrium model of trade between three countries.[5] We present as well a general set of preferences for governments that allows for both economic and political considerations.

2.1. The economic environment

We assume that there is one home country and two foreign countries who trade two goods, x and y, that are normal goods in consumption and produced under conditions of increasing opportunity costs. Production takes place under perfect competition, facing tariffs on imports by each country. To simplify the exposition of our findings, we suppose

[3] For additional perspectives on the MFN rule in the GATT/WTO, see Bagwell and Staiger (1999b), Caplin and Krishna (1988), Choi (1995), Ludema (1991) and McCalman (2002). None of these papers consider the bilateral opportunism problem. Ethier (1998) independently raises some of the issues treated here. Horn and Mavroidis (2001) offer an excellent survey.

[4] This paper is also related to an important literature in Industrial Organization that considers multiparty negotiations. For example, McAfee and Schwartz (1994) and Segal (1999) consider the scope for bilateral opportunism, when a single seller contracts separately with different buyers. Nondiscrimination clauses may mitigate against the bilateral opportunism problem.

[5] We develop this model in greater detail elsewhere (Bagwell and Staiger, 1999a,c, 2002).

that each foreign country trades only with the home country, who imports x from each of its two foreign trading partners in exchange for exports of y. The home country is thus the only country that has the opportunity to set discriminatory tariffs across its trading partners.[6]

The home local relative price is denoted as $p \equiv p_x/p_y$, where p_x (p_y) is the local price of good x (y) in the home country. Similarly, the local relative price in foreign country i is denoted as $p^{*i} \equiv p_x^{*i}/p_y^{*i}$ for i=1,2. The ad valorem tariff that the home country places on imports of x from foreign country i is denoted as t^i, for i=1,2, and t^{*i} is the ad valorem tariff levied by foreign country i on imports of y from the home country. Throughout, we assume that these tariffs are nonprohibitive. We define the "world" (i.e. untaxed) relative price for trade between the home country and foreign country i as $p^{wi} \equiv p_x^{*i}/p_y$. Letting $\tau^i \equiv (1 + t^i)$ and $\tau^{*i} \equiv (1 + t^{*i})$, we then may represent local prices in terms of world prices and tariffs: $p = \tau^i p^{wi} \equiv p(\tau^i, p^{wi})$ and $p^{*i} = p^{wi}/\tau^{*i} \equiv p^{*i}(\tau^{*i}, p^{wi})$. Local prices are thus determined, once tariffs and world prices are given.

We observe that world prices are linked across bilateral trading relationships:

$$p^{wi} = [\tau^j/\tau^i]\, p^{wj} \tag{1}$$

One possibility is that the tariff policy of the home country is nondiscriminatory (i.e. the home country adopts MFN tariffs). In this case, we have that $\tau^1 = \tau^2$ and hence there is a single world price: $p^{wi} \equiv p^w$ for i=1,2. On the other hand, if the home country discriminates with its tariff policy, then $\tau^1 \neq \tau^2$ and hence there are different world prices: $p^{w1} \neq p^{w2}$. Finally, we note that the terms of trade for foreign country i are given simply as p^{wi}.

We next introduce notation for import and export volumes in each country. For foreign country i, imports of y and exports of x are denoted as $M^{*i}(p^{*i}, p^{wi})$ and $E^{*i}(p^{*i}, p^{wi})$, respectively. These functions represent differences between production and consumption in foreign country i, where production depends upon the local price while consumption is determined by the local price and also tariff revenue, where tariff revenue can itself be expressed as a function of the local price and the terms of trade.

The home country has multiple trading partners, with whom it may experience different terms of trade. Once again, domestic production depends upon the local price while domestic consumption is determined by the local price and tariff revenue. But the determination of tariff revenue is now more complex: if the home countrys tariffs are discriminatory, then its tariff revenue depends upon the total volume of x that it imports *and* the composition of this volume across the foreign trading partners. It is, however, still possible to express tariff revenue in terms of the local price and the terms of trade, once the

[6] This trading pattern arises when the home (each foreign) country is a natural importer of x (y), provided that discriminatory tariffs do not upset the natural pattern of trade. The latter is assured, e.g., if transportation costs between foreign countries are large as compared to the extent of discrimination in home tariffs, and indeed all of our propositions hold when there is a (iceberg) transportation cost associated with trade between the foreign countries. More generally, our assumptions serve only to ensure that it is possible for the home country to set discriminatory tariffs without prohibiting trade between it and its less-favored trading partner. We discuss a many-good extension in our working paper (Bagwell and Staiger, 1999c), in which trade between foreign countries might occur as well even absent discriminatory tariffs at home.

domestic countrys multilateral terms of trade is appropriately defined as a trade-weighted average of the set of bilateral world prices:

$$T(p^{*1}, p^{*2}, p^{w1}, p^{w2}) \equiv \sum_{i=1,2} s^{*i}(p^{*1}, p^{*2}, p^{w1}, p^{w2}) \cdot p^{wi}$$

where

$$s^{*i}(p^{*1}, p^{*2}, p^{w1}, p^{w2}) \equiv E^{*i}(p^{*i}, p^{wi}) / \sum_{j=1,2} E^{*j}(p^{*j}, p^{wj})$$

With this definition, home-country imports of x and exports of y may be denoted as $M(p, T)$ and $E(p, T)$, respectively. We refer to T as the home countrys terms of trade.[7] Using (1), if the home country adopts an MFN tariff policy, then $T = p^{wi} \equiv p^{w}$. A discriminatory tariff policy implies that $T \neq p^{wi}$ for all i.

Next, we consider the trade balance and market-clearing conditions. Home and foreign budget constraints imply that, for any prices, we have:

$$T \cdot M(p, T) = E(p, T) \tag{2}$$

$$M^{*i}(p^{*i}, p^{wi}) = p^{wi} \cdot E^{*i}(p^{*i}, p^{wi}), \quad i = 1, 2 \tag{3}$$

Given a vector of tariffs, $\tau \equiv (\tau^1, \tau^2, \tau^{*1}, \tau^{*2})$, we now consider the determination of the world prices. One restriction is given by the market-clearing requirement:

$$M(p, T) = \sum_{i=1,2} E^{*i}(p^{*i}, p^{wi}) \tag{4}$$

Combining the market-clearing requirement (4) with the linkage condition (1), we thus have two restrictions with which to determine the two equilibrium world prices as functions of the given tariffs. We represent the equilibrium world prices as $\tilde{p}^{wi}(\tau)$ for $i = 1, 2$, and we assume that they are uniquely determined as functions of the four tariffs. Notice that market clearing in the y market is assured by (2) and (3). Summarizing, with their selections of tariffs, governments determine the equilibrium world prices; in turn, the tariffs and equilibrium world prices imply equilibrium values for all local prices, so that equilibrium import and export volumes are determined as well.

2.2. Prices and tariffs

It is convenient now to present some basic assumptions that we maintain throughout the paper. We begin with the manner in which tariffs affect prices. We consider both the

[7] Observe that T is in fact a measure of the reciprocal of domestic terms of trade: an improvement in the domestic countrys terms of trade corresponds to a lower value for T.

possibility that the home country is able to set discriminatory tariffs and the possibility that home tariffs must conform to the MFN rule.

In the discriminatory case, we impose the following assumptions: (i) $\tilde{p}^{w1}$ is increasing in τ^2, τ^{*1} and τ^{*2} and is decreasing in τ^1, and (ii) $\tilde{p}^{w2}$ is increasing in τ^1, τ^{*1} and τ^{*2} and is decreasing in τ^2. Thus, if foreign country i confronts a higher tariff on its exports, then it experiences a reduction in its terms of trade. But if foreign country i raises its own tariff, or if the other countries raise tariffs on one another, then foreign country i experiences an improvement in its terms of trade. These restrictions direct attention to the ''standard'' situation, ensuring that our model does not succumb to the Lerner paradox.

Next, we consider the case in which the home country selects among MFN tariffs: $\tau \equiv \tau^1 = \tau^2$. We may then represent the equilibrium world price as $\tilde{p}^w(\tau, \tau^{*1}, \tau^{*2})$. Our assumption for this case is: $\tilde{p}^w$ is increasing in τ^{*1} and τ^{*2} and is decreasing in τ. As above, when foreign country i raises its own import tariff, or when foreign country j pursues a more protectionist policy, foreign country i experiences a terms of trade improvement. We assume further that an increase in the home (MFN) tariff improves the home-country terms of trade.

2.3. Government preferences

We equip governments with preferences that allow for a wide range of economic and political motivations. In particular, we represent the objectives of the home and foreign governments by the general functions $W(p, T)$ and $W^{*i}(p^{*i}, \tilde{p}^{wi})$ for $i=1,2$, where all prices and terms of trade are evaluated at their market-clearing levels. The basic assumption that we maintain is that, with local prices held fixed, each government strictly prefers an improvement in its terms of trade: $\partial W(p, T)/\partial T < 0$ and $\partial W^{*i}(p^{*i}, \tilde{p}^{wi})/\partial \tilde{p}^{wi} > 0$. This representation includes the standard possibility that governments maximize national income. As we detail in our earlier work (Bagwell and Staiger, 1999a), the leading political-economy models of trade policy are also captured within this formulation.

3. Welfare preservation

An important issue concerns the extent to which GATT/WTO rules prevent an opportunistic bilateral agreement. In this section, we take a first step in the investigation of this issue, by identifying rules on bilateral negotiations that *preserve* the welfare of the nonparticipating government.

Formally, we focus here on the following problem. Starting from an initial set of tariffs, $\tau_I \equiv (\tau_I^1, \tau_I^2, \tau_I^{*1}, \tau_I^{*2})$, suppose that the governments of the home country and foreign country i enter into a bilateral negotiation that results in a new set of tariffs, $\tau_N \equiv (\tau_N^1, \tau_N^2, \tau_N^{*1}, \tau_N^{*2})$, where $\tau_I^{*j} = \tau_N^{*j}$ since the tariff of the nonparticipating country is outside of the bilateral negotiation. Let $\tilde{p}_I^{wj}$ ($\tilde{p}_N^{wj}$) denote the equilibrium value of p^{wj} under the initial (new) set of tariffs; likewise, let $p_I^{*j} = \tilde{p}_I^{wj}/\tau_I^{*j}$ ($p_N^{*j} = \tilde{p}_N^{wj}/\tau_I^{*j}$) denote the local price in foreign country j under the initial (new) set of tariffs. We seek rules on the manner that $\boldsymbol{\tau}_N$ may be derived from $\boldsymbol{\tau}_I$ and under which the welfare of the nonparticipating government is unaltered: $W^{*j}(p_I^{*j}, \tilde{p}_I^{wj}) = W^{*j}(p_N^{*j}, \tilde{p}_N^{wj})$.

3.1. Terms of trade

It might be expected that a welfare-preservation rule could be defined only with reference to the particular preferences held by the government of foreign country *j*. This is not the case, however, as the following proposition confirms:

Proposition 1. (Welfare Preservation: Terms of Trade) *Any bilateral agreement between the governments of the home country and foreign country i that leaves unaltered foreign country js terms of trade also preserves the welfare of the government of foreign country j.*

To see the argument, observe that $W^{*j}(p^{*j}, \tilde{p}^{wj})$ is preserved when p^{*j} and $\tilde{p}^{wj}$ are unaltered. Proposition 1 posits that $\tilde{p}_I^{wj} = \tilde{p}_N^{wj}$, and with τ^{*j} fixed it then follows as well that $p_I^{*i} = p_N^{*i}$.

The problem of nonparticipant welfare preservation thus may be recast in terms of the preservation of the nonparticipants world price. We argue next that the problem equivalently may be recast in terms of the preservation of the nonparticipants export and import volumes. Specifically, we observe that the bilateral negotiation preserves foreign country *j*'s terms of trade ($\tilde{p}_I^{wj} = \tilde{p}_N^{wj}$) if and only if it preserves foreign country *j*'s export and import volumes:

$$E^{*j}(p_I^{*j}, \tilde{p}_I^{wj}) = E^{*j}(p_N^{*j}, \tilde{p}_N^{wj}) \text{ and } M^{*j}(p_I^{*j}, \tilde{p}_I^{wj}) = M^{*j}(p_N^{*j}, \tilde{p}_N^{wj}) \tag{5}$$

Given $\tau_I^{*j} = \tau_N^{*j}$, it is direct that $\tilde{p}_I^{wj} = \tilde{p}_N^{wj}$ implies (5). Going the other way, if the bilateral negotiation satisfies (5), then the trade balance condition (3) for the nonparticipating country *j* ensures that $\tilde{p}_I^{wj} = \tilde{p}_N^{wj}$. We may thus restate Proposition 1 as:

Proposition 2. (Welfare Preservation: Export and Import Volumes) *Any bilateral agreement between the governments of the home country and foreign country i that leaves unaltered foreign country js export and import volumes equivalently leaves unaltered foreign country j's terms of trade and thus also preserves the welfare of the government of foreign country j.*

Kemp and Wan (1976) make related observations, although they restrict attention to governments that maximize national income and negotiate bilaterally to free trade. As others have noted in this context, the practical merit of a rule that calls for world-price maintenance is not obvious.[8] Such a rule might require subtle adjustments in the tariff that the home country applies to exports from the nonparticipating country. At this point, Propositions 1 and 2 are best understood as offering theoretical insights that inform our search for welfare-preservation rules that have a firm grounding in GATT/WTO practice.

3.2. Reciprocity and MFN

Two of the central pillars of the GATT/WTO approach are the principles of reciprocity and nondiscrimination. We consider now the extent to which these principles protect the welfare of a nonparticipating government.

[8] See, e.g., the discussion in McMillan (1993), Srinivasan (1998) and Winters (1997).

We begin with the principle of reciprocity. Following our earlier work (Bagwell and Staiger, 1999a, 2001a), we say that a bilateral negotiation between the governments of the home country and foreign country i conforms to *the principle of reciprocity* whenever for each of these countries the change in the volume of its imports is of equal value to the change in the volume of its exports, where changes in trade volumes are valued at the existing world price. For foreign country i, the principle of reciprocity thus requires that:

$$M^{*i}(p_N^{*i},\tilde{p}_N^{wi}) - M^{*i}(p_I^{*i},\tilde{p}_I^{wi}) = \tilde{p}_I^{wi} \cdot [E^{*i}(p_N^{*i},\tilde{p}_N^{wi}) - E^{*i}(p_I^{*i},\tilde{p}_I^{wi})] \tag{6}$$

We now record an important property of reciprocity:

Lemma 1. *Any bilateral agreement between the governments of the home country and foreign country i that satisfies the principle of reciprocity leaves unaltered the terms of trade between these countries.*

The proof is simple. Since foreign country is trade balance condition must hold at the initial tariffs, we may apply (3) to (6) and restate the reciprocity requirement as $M^{*i}(p_N^{*i},\tilde{p}_N^{wi}) = \tilde{p}_I^{wi} \cdot E^{*i}(p_N^{*i},\tilde{p}_N^{wi})$. But foreign country is trade balance requirement must hold also at the new tariffs, and so $\tilde{p}_I^{wi} = \tilde{p}_N^{wi}$.

Any bilateral negotiation satisfying reciprocity thus preserves the world price between the negotiating governments. But the principle of reciprocity does not, on its own, ensure that the welfare of the nonparticipating government is preserved. Reciprocity fixes the world price $\tilde{p}^{wi}$, whereas the welfare of the government of foreign country j is preserved when the world price $\tilde{p}^{wj}$ is fixed.

Similarly, the principle of nondiscrimination does not, on its own, suffice to preserve the welfare of the nonparticipating government. As mentioned in Section 2, under the MFN requirement, the government of the home country sets a single tariff on both of its trading partners, and a single world price, $\tilde{p}_k^w \equiv \tilde{p}_k^{w1} = \tilde{p}_k^{w2}$, where $k = I, N$, is thus determined. But the governments of the home country and foreign country i could potentially engage in a bilateral negotiation that changes this world price: $\tilde{p}_N^w \neq \tilde{p}_I^w$. In this case, their bilateral negotiation could alter the welfare of the government of foreign country j.

Finally, suppose that the bilateral negotiation between the governments of the home country and foreign country i must satisfy both the principles of reciprocity and nondiscrimination. Then, reciprocity fixes the world price between the negotiating countries, which under the MFN requirement ensures as well that the nonparticipants world price is fixed.

Proposition 3. (Welfare Preservation: Reciprocity and MFN) *Any bilateral agreement between the governments of the home country and foreign country i that satisfies the principles of reciprocity and nondiscrimination leaves unaltered foreign country js terms of trade and therefore preserves the welfare of the government of foreign country j.*

In effect, reciprocity and MFN work in tandem to maintain the export and import volumes of the nonparticipating country. As noted above, an explicit volume-preservation rule could be cumbersome, as it is suggestive of subtle adjustments in the tariff that the home government applies to the nonparticipant. By contrast, the MFN restriction serves as a simple means by which to multilateralize bilateral negotiations, and, remarkably, reciprocity then ensures that the multilateral presence so achieved preserves nonparticipant welfare.

3.3. Remaining issues

To this point, we have focused on rules for bilateral negotiation that *preserve* the welfare of a nonparticipating government. The tandem rules of reciprocity and nondiscrimination have this welfare-preservation property, and they are therefore sufficient to preclude opportunistic bilateral agreements. An important remaining issue concerns the probable extent to which these rules are necessary.

Our investigation of this issue is the second step in our analysis. We ask two questions. First, in the absence of any rules, would there exist bilateral agreements that lower the welfare of the nonparticipating government *and* are attractive to the participating governments? In short, how significant is the bilateral opportunism problem, anyway? Second, even if the problem is significant, might it be solved with "weak" rules? In particular, if any bilateral negotiation were required only to honor the MFN rule, would there exist bilateral agreements that lower the welfare of the nonparticipating government *and* are attractive to the participating governments?

We do not offer conclusive answers to these questions. As a general matter, the benefits to a bilateral agreement may be influenced by the position of the initial tariffs and by the participants' beliefs regarding the future responses and/or agreements that a nonparticipating government might make. Still, we may gain some insight by characterizing the efficiency frontier, positioning the initial tariffs on this frontier, specifying the rules (if any) that govern bilateral negotiations, and then asking: does there exist a permitted bilateral agreement for the governments of the home country and any foreign country i under which they each gain, when they take as fixed the tariff policy of foreign country j ?

A convenient feature of this approach is that, if such an agreement does exist, then it is assuredly opportunistic: starting at the efficiency frontier, the participating governments can gain only if the nonparticipating government is harmed. A limitation is that the nonparticipants eventual response to the bilateral agreement is not modeled. On net, we believe that this approach represents a useful beginning towards an understanding of the potential significance of the bilateral opportunism problem when rules are absent or weak.[9]

[9] A specific game that can provide formal justification for our focus is the following. Fix an efficient tariff vector and the rules (if any) that govern bilateral negotiations. In stage 1, the home government makes each foreign government i an offer (τ^i, τ^i) which is privately observed by foreign government i. In stage 2, each foreign government simultaneously decides whether to accept or reject, holding passive beliefs about the offer faced by the other foreign government (McAfee and Schwartz, 1994). The outcome of this game under the rules of negotiation associated with each of the Propositions 5, 6, 8 and 9 that follow shares the efficiency properties suggested by each proposition. This interpretation builds from Segals (1999) analysis.

4. Discriminatory environments

We start with a permissive setting, in which discriminatory tariffs are allowed.

4.1. Government preferences in reduced form

To begin, we represent government welfare in reduced form as a direct function of tariffs. Let $\hat{W}(\boldsymbol{\tau}) \equiv W(p, T)$ and $\hat{W}^{*i}(\boldsymbol{\tau}) \equiv W^{*i}(p^{*i}, \tilde{p}^{wi})$, where all prices and terms of trade are evaluated at their market-clearing levels.

We now strengthen our basic assumptions slightly, so as to focus on tariffs for which externalities can be unambiguously signed:

Assumption 1. (Externalities) We restrict attention to tariffs for which, for $i, j = 1, 2$ and $i \neq j$:

(i) $\partial \hat{W}/\partial \tau^i > 0$ and $\partial \hat{W}^{*i}/\partial \tau^{*i} > 0$;
(ii) $\partial \hat{W}/\partial \tau^{*i} < 0$ and $\partial \hat{W}^{*i}/\partial \tau^i < 0$; and
(iii) $\partial \hat{W}^{*i}/\partial \tau^{*j} > 0$ and $\partial \hat{W}^{*i}/\partial \tau^j > 0$

Thus, we will consider initial tariffs that rest on the efficiency frontier at a point where: (i) each government would prefer to unilaterally raise its tariff; (ii) each government experiences a welfare reduction when its export good is confronted with a higher tariff from a trading partner; and (iii) foreign government i is pleased when either the home government raises its tariff on the exports of foreign country j or foreign government j raises its tariff on the exports of the home country. These relationships follow directly from the model of Section 2, so long as government welfare at the initial tariffs is sufficiently sensitive to the terms-of-trade change that an adjustment in tariffs would imply.

Assumption 1 directs attention to the set of efficient trade agreements that are suggested by the nature of GATT tariff bindings. The essential legal commitment associated with GATT bindings is that governments agree not to raise their tariffs *above* bound levels. It would be difficult to reconcile the value that governments evidently place on such commitments with points on the efficiency frontier that did not satisfy assumptions (i) and (ii). And using the model of Section 2, it can be shown that assumption (iii) is in fact implied by (ii).[10] In line with GATT/WTO practice, these assumptions also indicate that each government views a tariff reduction on its part as a concession that is potentially appealing if a trading partner reciprocates with a tariff reduction of its own.

4.2. Characterization of efficient tariffs

At an efficient set of tariffs, no one government can gain from an adjustment in the tariff vector, without simultaneously reducing the welfare of at least one other

[10] The impact of a change in τ^{*j} or τ^j on the welfare of foreign country i travels through $\tilde{p}^{wi}$, as does the impact on the welfare of foreign country i of a change in τ^i. Our assumptions relating tariffs to equilibrium world prices are thus sufficient to establish that (ii) implies (iii).

government. An efficient vector of tariffs, $\tau_e \equiv (\tau_e^1, \tau_e^2, \tau_e^{*j}, \tau_e^{*j})$, must therefore solve the following program:

Program W. Choose $\boldsymbol{\tau}$ to maximize $\hat{W}(\boldsymbol{\tau})$

$$\text{s.t.} \hat{W}^{*i}(\boldsymbol{\tau}) \geq \hat{W}^{*i}(\boldsymbol{\tau}_e), \text{ for } i = 1, 2$$

We omit a formal analysis of this program, as the solution may be easily characterized with the assistance of some simple figures. We begin with a characterization of the efficient tariffs:

Proposition 4. (Efficient Tariffs) *If $\boldsymbol{\tau}_e$ is an efficient vector of tariffs, then for i,j=1,2 and $i \neq j$, we must have that*

$$-\frac{\partial \hat{W}/\partial \tau^{*i}}{\partial \hat{W}/\partial \tau^{i}} > -\frac{\partial \hat{W}^{*i}/\partial \tau^{*i}}{\partial \hat{W}^{*i}/\partial \tau^{i}} > 0 > -\frac{\partial \hat{W}^{*j}/\partial \tau^{*i}}{\partial \hat{W}^{*j}/\partial \tau^{i}}$$

To interpret the characterization, we refer to Fig. 1. We observe first that the iso-welfare curve for the home-country government is positively sloped over the relevant region. This simply reflects that the home government trades off a higher own tariff (which is good)

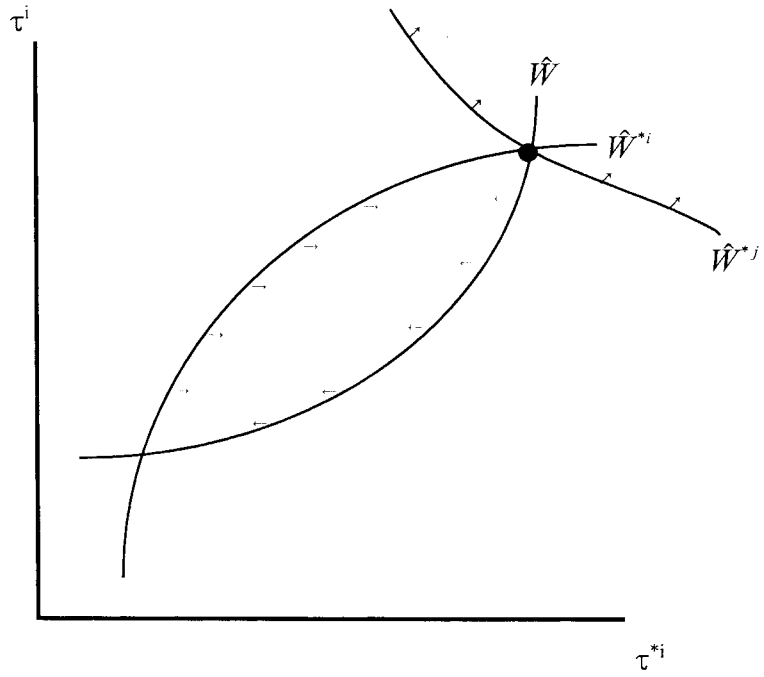

Fig. 1. Efficient Tariffs.

against a higher tariff from foreign country i (which is bad) when the home-country governments welfare is held fixed. The iso-welfare curve of the government of foreign country i is positively sloped for the same reason. Second, we observe that the iso-welfare curve for the government of foreign country j is negatively sloped, since it benefits from an increase in either tariff. Third, we observe that the home-government iso-welfare curve is steeper than that of foreign government i at the efficient point, and so an efficient tariff vector leaves a lens in which the governments of the home country and foreign country i could experience welfare gains. We note that the lens lies below the iso-welfare curve of the government of foreign country j.

To understand the location of the lens, it is instructive to entertain the other possibilities. One possibility is that the lens lies above the iso-welfare curve of the government of foreign country j. But if this were the case, then it would be possible to raise the two tariffs in a way that offered gains to all three governments. A second possibility is that there is no lens: the iso-welfare curves of the governments of the home country and foreign country i are tangent at the point at which they intersect the iso-welfare curve of the government of foreign country j. This arrangement fails to solve Program W as well, but a more involved alteration of tariffs is now required to produce Pareto improvements. For example, raising τ^i and τ^{*i} along the iso-welfare curve of foreign country i will cause the home-country government to experience a second-order welfare loss, while generating a first-order welfare benefit for the government of foreign country j. Adjustments to τ^j and τ^{*j} can then be found that ensure gains for all three governments.[11]

4.3. Bilateral opportunism

Starting with an efficient tariff vector, we now consider the possibility of a bilateral agreement in which the governments of the home country and some foreign country i adjust the tariffs under their control, (τ^i,τ^j) and τ^{*i}. Given a set of rules for bilateral negotiations, we say that an initial efficient tariff vector is *vulnerable to bilateral opportunism* if there exists a foreign country i and a bilateral agreement between this country and the home country such that the governments of the home country and foreign country i both gain. We establish next that the bilateral opportunism problem is potentially severe: without strong rules, *all* efficient tariff vectors are vulnerable to bilateral opportunism.

This conclusion follows immediately when there are no rules that govern bilateral negotiations. In that case, the home government could raise τ^j as part of its bilateral negotiation with the government of foreign country i; furthermore, under Assumption 1, the home government and the government of foreign country i would both gain when the

[11] In the tangency case, the welfares of the governments of the home country and foreign country j can be increased while maintaining the welfare of the government of foreign country i if we adjust tariffs according to the following procedure: (i). increase τ^i and τ^{*i} so as to preserve $\hat{W}^{*i}$, thereby creating a second-order loss (first-order gain) for $\hat{W}$ ($\hat{W}^{*j}$); (ii). raise τ^j and lower τ^{*j} so as to preserve $\hat{W}^{*i}$, thereby creating a first-order gain (first-order loss) for $\hat{W}$ ($\hat{W}^{*j}$); and (iii). ensure that the first adjustment is large as compared to the second, thereby creating a net gain for $\hat{W}^{*j}$.

home government raises τ^j. Thus, in the absence of any rules governing bilateral negotiations, all efficient tariff vectors are vulnerable to bilateral opportunism.

As noted above, however, a tariff concession made in a previous GATT agreement is "bound", and the tariff therefore cannot be raised above its bound level in a subsequent negotiation, unless the trading partner on whose exports the bound tariff applies is represented. This binding restriction eliminates the potential of the home government to raise τ^j as part of its bilateral agreement with the government of foreign country *i*. Does the binding restriction suffice to eliminate the bilateral opportunism problem?

As Fig. 1 reveals, the binding restriction fails to eliminate the bilateral opportunism problem. The governments of the home country and foreign country *i* can still gain by *lowering* the tariffs that they apply to one another:

Proposition 5. (Bindings and Efficient Tariffs) *Whether or not a bindings restriction is imposed, every efficient tariff vector is vulnerable to bilateral opportunism.*

By lowering the tariffs that they apply to one another, the governments of the home country and foreign country *i* enjoy a welfare gain that effectively derives from the terms-of-trade loss experienced by foreign country *j*.

We consider next the reciprocity rule. Recall from Lemma 1 that a bilateral agreement between the governments of the home country and foreign country *i* that satisfies the principle of reciprocity must leave unaltered the terms of trade between these two countries. It is thus evident from Fig. 1 that the principle of reciprocity will fail to block an opportunistic agreement between the home country and foreign country *i* if and only if the (positively sloped) iso-$\tilde{p}^{wi}$ locus passing through the efficient point in Fig. 1 enters the lens. When this is the case, both the home-country government and the government of foreign country *i* seek lower tariffs and greater trade volume at the given terms of trade between these two countries. Hence we have:

Proposition 6. (Reciprocity and Efficient Tariffs) *Under bindings and the principle of reciprocity, an efficient tariff vector is vulnerable to bilateral opportunism if and only if there exists* $i \in \{1,2\}$ *such that the home-country government and the government of foreign country i seek lower tariffs and greater trade volume at the given terms of trade between them.*

The principle of reciprocity can thus solve the bilateral opportunism problem at points on the efficiency frontier at which, for each bilateral relationship, one of the two governments would seek a (weakly) higher tariff and less trade volume at the given terms of trade between them. But at any point on the efficiency frontier where this condition is not met, there will exist a foreign government *i* with whom the home government can engage in opportunistic reciprocal liberalization. Through their liberalization, the government of foreign country *i* receives a beneficial increase in trade volume at a fixed terms of trade. The home government also benefits, and its benefit is made possible by the implied terms-of-trade improvement against foreign country *j*. Hence, when the principle of reciprocity is applied in a discriminatory

environment, the bilateral opportunism problem remains for a significant set of points on the efficiency frontier.

5. Nondiscriminatory environment

We suppose now that both the initial tariffs and the tariffs associated with any future bilateral negotiation must conform to the MFN rule. This rule alters both the efficiency frontier and the incentives for bilateral opportunism.

5.1. Government preferences in reduced form

When the home government is restricted by the MFN requirement, the total number of tariffs is reduced to three: $\tau \equiv \tau^1 = \tau^2$, τ^{*1} and τ^{*2}. For this situation, we may define the reduced-form preferences for governments as follows: $\overline{W}(\tau, \tau^{*1}, \tau^{*2}) \equiv \hat{W}(\tau, \tau, \tau^{*1}, \tau^{*2}) \equiv W(p, T)$ and $\overline{W}^{*i}(\tau, \tau^{*1}, \tau^{*2}) \equiv \hat{W}^{*i}(\tau, \tau, \tau^{*1}, \tau^{*2}) \equiv W^{*i}(p^{*i}, \tilde{p}^{wi})$, where all prices and terms of trade are evaluated at their market-clearing levels. That is, $\overline{W}$ and $\overline{W}^{*i}$ are simply $\hat{W}$ and $\hat{W}^{*i}$, respectively, with the MFN constraint $\tau \equiv \tau^1 = \tau^2$ imposed. Recall from Section 2 that, under the MFN restriction, there will now be a single world price, and so we also have that $T = \tilde{p}^{wi} \equiv \tilde{p}^{w}$.

In analogy with Assumption 1 for discriminatory tariff environments, we now strengthen our basic assumptions, so as to focus on MFN tariffs for which externalities can be unambiguously signed:

Assumption 1′. (Externalities: MFN) We restrict attention to tariffs for which, for i,j=1,2 and $i \neq j$:

(i) $\partial \overline{W}/\partial \tau > 0$ and $\partial \overline{W}^{*i}/\partial \tau^{*i} > 0$;
(ii) $\partial \overline{W}/\partial \tau^{*i} < 0$ and $\partial \overline{W}^{*i}/\partial \tau < 0$; and
(iii) $\partial \overline{W}^{*i}/\partial \tau^{*j} > 0$

Thus, we consider negotiated MFN tariffs at which each government would prefer to unilaterally raise its tariff, each government experiences a welfare reduction when its export good is confronted with a higher tariff from a trading partner, and foreign government i is pleased when foreign government j raises its tariff on the exports of the home country. Again, this assumption directs attention to (MFN-efficient) tariffs at which the welfare consequences of tariff changes are consistent with their terms-of-trade effects and the nature of GATT bindings.

5.2. Characterization of MFN-efficient tariffs

We now characterize the set of tariffs that are efficient in the MFN class. The efficient tariffs characterized in the previous section for which $\tau^1 = \tau^2$ are of course also efficient in the MFN class, but a tariff vector that is efficient in the MFN class need not be efficient in the full class of (discriminatory) tariff vectors. We continue to denote the vector of tariffs by

$\boldsymbol{\tau} \equiv (\tau, \tau^{*1}, \tau^{*2})$, noting that in this MFN environment now has three elements. Formally, an MFN-efficient vector of tariffs, $\boldsymbol{\tau}_m \equiv (\tau_m, \tau_m^{*1}, \tau_m^{*2})$, must solve the following program:

Program MFN−W. Choose $\boldsymbol{\tau}$ to maximize $\overline{W}(\boldsymbol{\tau})$

$$\text{s.t. } \overline{W}^{*i}(\boldsymbol{\tau}) \geq \overline{W}^{*i}(\boldsymbol{\tau}_m), \text{ for } i = 1, 2$$

As compared to the characterization of efficient tariffs when discrimination is allowed, the lack of two independent home-country tariffs under the restriction of MFN complicates somewhat the characterization of the set of MFN-efficient tariffs. Consequently, while we continue to rely heavily on a series of figures to illustrate the main points, we provide a formal analysis of this program in the Appendix. We establish there that:

Proposition 7. (MFN-Efficient Tariffs). *If $\boldsymbol{\tau}_m$ is an MFN-efficient vector of tariffs, then for $i,j = 1,2$ and $i \neq j$, either:*

$$(i) \qquad -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} > -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} > -\frac{\partial \overline{W}^{*i}/\partial \tau^{i}}{\partial \overline{W}^{*i}/\partial \tau};$$

$$(ii) \qquad -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} < -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} < -\frac{\partial \overline{W}^{*i}/\partial \tau^{*i}}{\partial \overline{W}^{*i}/\partial \tau}; \quad \text{or}$$

$$(iii) \qquad -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} = -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} \gtrless -\frac{\partial \overline{W}^{*i}/\partial \tau^{*i}}{\partial \overline{W}^{*i}/\partial \tau};$$

Fig. 2AC depicts the implications of conditions (i), (ii) and (iii) of Proposition 7, respectively. Each figure reflects, at the efficient point, the ranking of the iso-welfare-curve slopes of the three governments which is implied by the associated condition (all slopes are positive by Assumption 1′). The three cases are organized on the basis of whether the iso-welfare curve of the government of foreign country $j \neq i$ is steeper than (case (i)), flatter than (case (ii)), or tangent to (case (iii)) the iso-welfare curve of the home government. In (τ, τ^{*i}) space, the iso-welfare curve of the government of foreign country $j \neq i$ is also the iso-p^w locus; thus, any movement to the right of this locus raises $\tilde{p}^w$ or equivalently (by Assumption 1′) benefits the government of foreign country j.

Consequently, in case (i) the government of the home country seeks a higher tariff and less trade volume, given the world price, with its preferred outcome occurring at point H in Fig. 2A. Efficiency then requires that each foreign country would gain from lowering its tariff and achieving more trade volume, if the world price were fixed. Similarly, in case (ii) the government of the home country seeks a lower tariff and more trade volume, given the world price, with its preferred outcome occurring at point L in Fig. 2B, and efficiency then requires that each foreign country seek a higher tariff and less trade volume at the given world price. Finally, in case (iii) the government of the home country achieves its preferred trade volume given the world price, and efficiency requires that at least one foreign government achieves its preferred trade volume. Intuitively, the downward lens in Fig. 2A can be understood as follows. If the iso-welfare curve of the government of foreign country $j \neq i$ is steeper than the iso-welfare

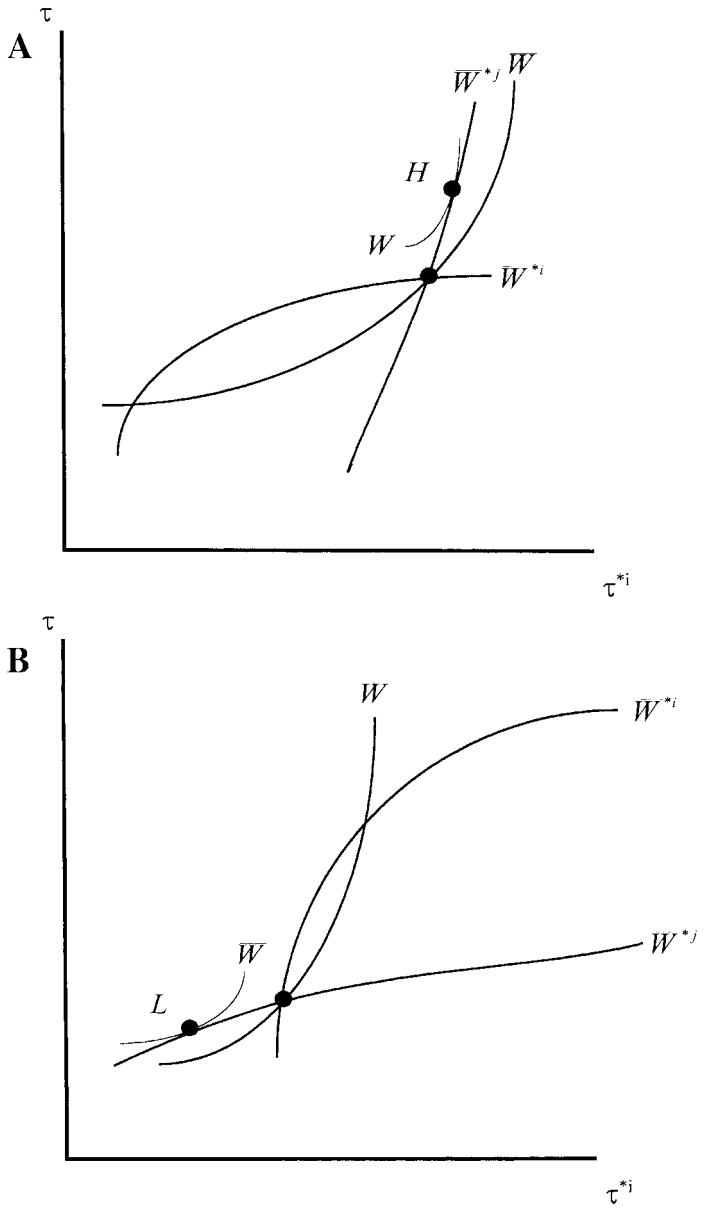

Fig. 2. MFN-Efficient Tariffs.

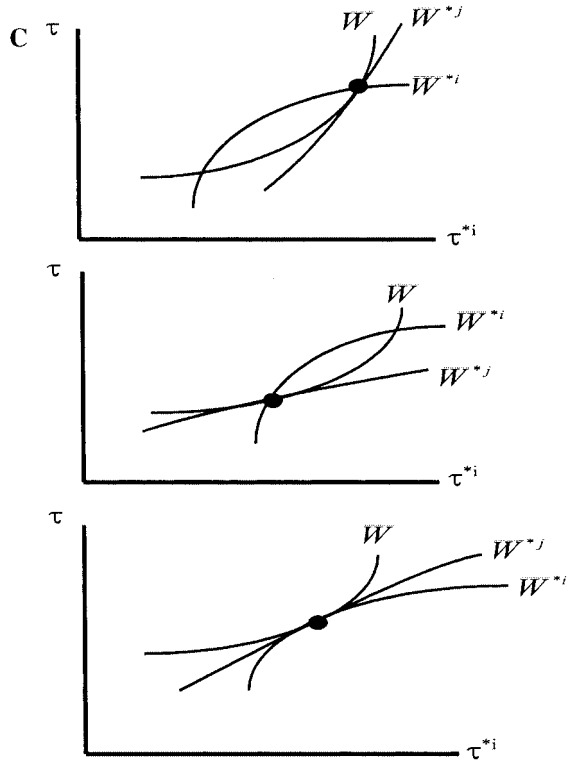

Fig. 2 (*continued*).

curve of the home government (case (i)), then an upward lens between the home government and the government of foreign country *i* would have to contain, or lie to the right of, the iso-welfare curve of the government of foreign country *j*. But this would not be compatible with efficiency, because it would then be feasible to move into the lens and benefit all three governments. The absence of a lens (i.e. a tangency) between the home government and the government of foreign country *i* is also incompatible with efficiency in case (i).[12] The upward lens described in Fig. 2B can be similarly understood.

[12] To see this, hypothesize a tangency and consider the following two-step procedure. First, increase τ and τ^{*i} slightly along the iso-welfare curve of the government of foreign country *i*, creating a first-order gain for the government of foreign country *j* (via the rise in $\tilde{p}^w$) and a second-order loss for the home government. Second, raise τ and τ^{*j} slightly along the iso-welfare curve of the government of foreign country *i* (i.e. along the new iso-$\tilde{p}^w$ locus), so as to eliminate the second-order welfare loss while preserving a first-order welfare gain for the government of foreign country *j* (recall that this is the direction preferred by the home government in case (i)). This two-step procedure would yield a Pareto improvement over the initial tariffs, and hence the absence of a lens between the home government and the government of foreign country *i* is also incompatible with efficiency in case (i).

Finally, if the iso-welfare curve of the government of foreign country $j \neq i$ is tangent to the iso-welfare curve of the home government (case (iii)), then the home government achieves its preferred trade volume at the given world price, and the presence of a lens between the home government and the government of foreign country i no longer signals the possibility of Pareto-improving tariff changes. As a consequence, each of the possibilities illustrated in Fig. 2C can arise at points on the efficiency frontier.[13] The bottom panel of Fig. 2C depicts the case in which all governments are content with the trade volumes achieved at the given world prices. The tariffs that support such an arrangement are the tariffs that governments would choose were they to "ignore" any terms-of-trade effects of their tariff choices. When governments maximize national income, these tariffs correspond to multilateral free trade. Following our earlier work (Bagwell and Staiger, 1999a, 2001a), we refer to these tariffs as the *MFN politically optimal tariffs*.

5.3. Bilateral opportunism

We now consider the circumstances under which an initial vector of MFN-efficient tariffs is vulnerable to bilateral opportunism, when the bilateral agreement must honor the MFN rule.

Consider first Fig. 2A. In this case, the MFN-efficient tariff vector is vulnerable, as the home government and the government of foreign country i can negotiate a further reduction in τ and τ^{*i} which yields a Pareto gain for them (i.e. moves them into the lens in Fig. 2A) at the expense of the government of foreign country j, who suffers a terms-of-trade decline. Hence, for MFN-efficient tariff vectors at which the home government seeks a higher tariff and reduced trade volume at the given world price, there is a bilateral opportunism problem. Notice, too, that this problem remains when the bilateral negotiations must honor the MFN rule as well as a bindings requirement.

This case is of special interest. The government of foreign country j is harmed, even though it does not alter its own tariff and receives an MFN tariff *reduction* from the home country. Intuitively, foreign country j is harmed by a deterioration in its terms of trade: the tariff reduction given by foreign country i raises the cost of home exports in foreign country j, and this negative effect can be engineered to overwhelm the beneficial effect of a reduced home tariff on exports from foreign country j. To understand how the home government and the government of foreign country i can gain from this maneuver, recall that in this case the governments of the foreign

[13] Consider the downward-lens case (illustrated in the top panel). The government of foreign country i then seeks a lower tariff and greater trade volume at the given world price. A natural candidate for generating a Pareto improvement would be to first reduce τ and τ^{*i} slightly along the iso-welfare curve of the government of foreign country j, creating a first-order gain for the government of foreign country i and a second-order loss for the home government. The problem is, there are not sufficient instruments to then undo the home governments second-order loss, because the government of foreign country j cannot receive a lower world price without suffering a welfare decline, while the home government must receive a lower world price if its second-order loss is to be offset (while maintaining a first-order gain for the government of foreign country i). Hence, no Pareto improvement is possible.

countries each desire greater trade, given the world price, while the government of the home country does not. The home government, however, will accept a greater bilateral trade volume if this comes with an improved terms of trade. In a bilateral negotiation, this can be accomplished if the government of foreign country i reduces its tariff "more" than does the government of the home country.

Consider next Fig. 2B. Here the government of the home country seeks a reduced tariff and more trade volume at the given world price, while the government of each foreign country seeks less trade volume. An upward lens reflects a gain that the governments of the home country and foreign country i can enjoy at the expense of the government of foreign country j. In the absence of bindings, this tariff vector is thus vulnerable to bilateral opportunism. But in the presence of a bindings restriction, τ cannot be increased, and hence the tariff vector is not vulnerable. In sum, for MFN-efficient tariff vectors at which the home government seeks more trade volume at the given world price, there is a bilateral opportunism problem if and only if bindings are absent.

Finally, consider Fig. 2C. In this case, the home government achieves its preferred trade volume at the given world price, and efficiency then requires as well that at least one of the foreign governments, say j, must achieve its preferred trade volume at the given world price as well. In the top (middle) panel, the governments of the home country and foreign country i face circumstances analogous to those that they face in Fig. 2A (2B), and so there is a bilateral opportunism problem with or without bindings (if and only if bindings are absent). The bottom panel of Fig. 2C depicts the case in which foreign government i also achieves its preferred trade volume at the given world price. This is the case of MFN politically optimal tariffs. As the bottom panel makes clear, the MFN politically optimal tariff vector exhibits no lens, and hence it is not vulnerable to bilateral opportunism whether or not bindings are imposed.

We may now state:

Proposition 8. (MFN and Efficient ariffs) *(A) Under the MFN Rule, an MFN-efficient tariff vector is not vulnerable to bilateral opportunism if and only if it is politically optimal.*

(B) Under bindings and the MFN Rule, an MFN-efficient tariff vector is not vulnerable to bilateral opportunism if and only if: (i) the home government seeks a lower tariff and greater trade volume, given the world price; or (ii) the home government achieves its preferred trade volume given the world price, and neither foreign country seeks a lower tariff and greater trade volume given the world price.

As Proposition 8 indicates, the MFN rule on its own offers only a partial solution to the bilateral opportunism problem. In the absence of bindings, the MFN rule guarantees that exactly one MFN-efficient tariff vector is protected from bilateral opportunism; and even when the MFN rule is joined with a bindings restriction, a subset of MFN-efficient tariff vectors remain vulnerable.

By contrast, if the MFN rule were combined with the reciprocity rule, then the welfare of the nonparticipating government would be preserved in any bilateral agreement, and so no MFN-efficient tariff vector would be vulnerable to bilateral opportunism. In terms of Fig. 2AC, reciprocity restricts bilateral negotiations between the domestic government and the government of foreign country i to remain along the iso-$\overline{W}^{*j}$(equivalently, iso-$\tilde{p}^{w}$) locus, which never enters the lens between them. When

joined with Proposition 8, this observation suggests that the principle of reciprocity enhances significantly the power of the principle of nondiscrimination in dealing with bilateral opportunism.

6. Nonviolation nullification-or-impairment

While we have modeled MFN and reciprocity as rigid rules, their application in GATT/WTO practice is more qualified. But nonparticipant welfare may also be protected through other GATT/WTO provisions. We analyze here the potential role of GATT Article XXIII nonviolation nullification-or-impairment complaints in protecting nonparticipant welfare. We ask whether the nullification-or-impairment rule might provide a separate defense against bilateral opportunism, even when the reciprocity and MFN rules are not imposed.[14]

Our analysis requires a definition of market access. To begin, we thus return to the underlying model in Section 2. Consider a given vector of tariffs, $\boldsymbol{\tau}$. Using the linkage condition (1), we may define the function $p_L^{wi}(\tau^i, \tau^j, p^{wj}) \equiv [\tau^j/\tau^i]p^{wj}$. With this definition, the domestic countrys terms of trade may be expressed as a function of $\boldsymbol{\tau}$ and p^{wj}:

$$T_L(\boldsymbol{\tau}, p^{wj}) \equiv T(p^{*j}, p^{*i}, p^{wj}, p_L^{wi})$$

where $p^{*j} \equiv p^{*j}(\tau^{*j}, p^{wj})$ and $p^{*i} \equiv p^{*i}(\tau^{*i}, p_L^{wi})$. For a given vector of tariffs $\boldsymbol{\tau}$, the *market access* that the domestic country affords to foreign country j at world price p^{wj} then may be defined as:

$$MA^j(\boldsymbol{\tau}, p^{wj}) \equiv M(p, T_L) - E^{*i}(p^{*i}, p_L^{wi}) \tag{7}$$

where $p \equiv p(\tau^j, p^{wj})$. Effectively, this amounts to the "residual" import demand faced by exporters from foreign country j at $\boldsymbol{\tau}$ and p^{wj}. Note that the market-clearing condition (4) now may be rewritten equivalently as:

$$MA^j(\boldsymbol{\tau}, p^{wj}) = E^{*j}(p^{*j}, p^{wj}) \tag{8}$$

Under market clearing, the market access that the home country offers exporters from foreign country j equals the export supply from foreign country j.

We next observe a relationship between changes in the terms of trade and changes in market access. In a two-country model, the Marshall-Lerner (global) stability condition ensures that an inward shift of the domestic import demand curve at every world price

[14] A second reason for considering nonviolation nullification-or-impairment provisions in the context of bilateral opportunism problems is that new complications arise when many goods are considered. In our working paper (Bagwell and Staiger, 1999c), we show that MFN and reciprocity continue to solve the terms-of-trade driven bilateral opportunism problem, but an additional problem of bilateral opportunism (associated with local price movements) may still arise under these rules in limited circumstances. In this light, a limited role for nonviolation complaints could arise in a many-good setting even if reciprocity and MFN were rigidly applied.

results in a lower equilibrium world price. We assume the analogous stability condition in our three-country model.[15] In a discriminatory setting, this means that a reduction in the market access that the domestic country affords to foreign country j at every p^{wj}—engineered with any combination of changes in (τ^i, τ^j) and τ^{*i}—results in a lower $\tilde{p}^{wj}$. In an MFN environment, this means that a reduction in the market access that the domestic country affords to foreign country j at every p^w—engineered with any combination of changes in τ and τ^{*i}—results in a lower $\tilde{p}^w$. In both environments, the MarshallLerner stability condition ensures that, for a given vector of tariffs, the equilibrium world price (which satisfies (8)) is uniquely determined.

We now consider the possible role of nonviolation nullification-or-impairment complaints in preventing the problem of bilateral opportunism. As detailed in GATT Article XXIII, these complaints can be lodged when a government believes that market access it had previously won through negotiations is subsequently denied unexpectedly as a result of measures taken by its negotiating partner. In principle the ability to bring such complaints could prevent the domestic country and foreign country i from negotiating in a way which reclaimed from foreign country j a portion of the domestic market access that country j had previously negotiated. More formally, we may say that bilateral negotiations between the domestic country and foreign country i satisfy the *nullification-or-impairment rule* whenever

$$MA^j(\boldsymbol{\tau}_N, \tilde{p}_I^{wj}) \geq MA^j(\boldsymbol{\tau}_I, \tilde{p}_I^{wj}) \tag{9}$$

But under our stability condition, bilateral negotiations between the domestic country and foreign country i that satisfy the nullification-or-impairment rule in discriminatory environments must not diminish $\tilde{p}^{wj}$, while under the MFN rule such negotiations must not diminish $\tilde{p}^w$. As movement into the lens described in Fig. 1 requires a diminished $\tilde{p}^{wj}$, while movement into the lens described by 2AC all require a diminished $\tilde{p}^w$, it follows that, beginning from the efficiency frontier, all opportunistic bilateral agreements are precluded under the nullification-or-impairment rule. Thus we have:

Proposition 9. (Nullification-or-impairment rule and efficient tariffs) *Under the nullification-or-impairment rule, no efficient tariff vector is vulnerable to bilateral opportunism.*

Using Proposition 9, we have a formal basis from which to interpret the nullification-or-impairment rule as playing a potentially important role in solving the bilateral opportunism problem. But the nullification-or-impairment rule would by itself be a cumbersome solution to a problem which, as Proposition 5 indicates, is pervasive. In this

[15] Formally, in a two-country setting the Marshall-Lerner stability condition requires that, at the equilibrium world price, the elasticity of the domestic countrys import demand must be less than the elasticity of the foreign countrys export supply. We impose here the analogous condition that, at the equilibrium world price defined by (8), the elasticity of the market access that the domestic country affords to foreign country j must be less than the elasticity of foreign country j's export supply.

light, we may conclude from Propositions 3, 5, 6, 8 and 9 that MFN and reciprocity *together* can provide a *first line of defense* against bilateral opportunism. The nullification-or-impairment rule can then be understood as providing a *second line of defense* against bilateral opportunism.

7. Conclusion

Trade negotiations occur over time between many governments. A government may naturally fear that the extent of market access that it has secured in a current negotiation may be diminished in a future negotiation to which it is not party. Indeed, if a government recognizes the potential for an opportunistic bilateral negotiation in the future, then it may be unwilling to offer significant concessions in a current negotiation. As this discussion suggests, the degree to which the rules of a multilateral trading system protect through time the value of concessions is of central importance to the functioning of the system.

In this paper, we offer a formal analysis that characterizes the scope for opportunistic bilateral agreements under different negotiation rules. Our main finding is that the welfare of a nonparticipating government is preserved in the presence of any bilateral agreement that respects the principles of reciprocity and nondiscrimination. These principles thus constitute a powerful first-line of defense against the potential for opportunistic bilateral agreements.

We consider as well the possibilities for opportunism under weaker rules. We find that the potential for opportunistic bilateral agreements is severe when there are no rules. In addition, the possibility of bilateral opportunism remains when either reciprocity or nondiscrimination (but not both) is imposed. Of particular interest, nondiscrimination without reciprocity offers only a partial solution to the bilateral opportunism problem. Thus, while our results confirm the general point raised by Schwartz and Sykes (1997) that the nondiscrimination principle is beneficial as a means to protect the value of past concessions, our formal analysis reveals that this principle fully solves the bilateral opportunism problem only when it is applied in combination with the principle of reciprocity.

The findings here suggest that preferential tariff agreements, which are permitted under the special exception to MFN granted by GATTs Article XXIV, represent a possible route to opportunistic bilateral agreements. In this light, preferential tariff agreements may present a natural and appropriate target for nonviolation nullification-or-impairment complaints. More generally, our analysis suggests that the potential for nullification-or-impairment complaints can constitute a valuable second-line of defense against bilateral opportunism.

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Appendix A

Proof of Proposition 7. (MFN-Efficient Tariffs) To prove this proposition, we first identify some general relationships and then establish three lemmas. Here and throughout the Appendix, we denote partial derivatives by subscripts. We observe that for every $i,j \in \{1,2\}$ with $i \neq j$, we have:

$$\overline{W}_{\tau} = [W_p \tau + W_{\tilde{p}^w}] \frac{\partial \tilde{p}^w}{\partial \tau} + W_p \tilde{p}^w > 0 \tag{A.1}$$

$$\overline{W}_{\tau^{*i}} = [W_p \tau + W_{\tilde{p}^w}] \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} < 0 \tag{A.2}$$

$$\overline{W}^{*i}_{\tau^{*i}} = \left[W^{*i}_{p^{*i}} \frac{1}{\tau^{*i}} + W^{*i}_{\tilde{p}^w} \right] \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} - W^{*i}_{p^{*i}} \left(\frac{1}{\tau^{*i}} \right)^2 \tilde{p}^w > 0 \tag{A.3}$$

$$\overline{W}^{*i} = \left[W^{*i}_{p^{*i}} \frac{1}{\tau^{*i}} + W^{*i}_{\tilde{p}^w} \right] \frac{\tilde{p}^w}{\partial \tau} < 0 \tag{A.4}$$

$$\overline{W}^{*i}_{\tau^{*j}} = \left[W^{*i}_{p^{*i}} \frac{1}{\tau^{*i}} + W^{*i}_{\tilde{p}^w} \right] \frac{\partial \tilde{p}^w}{\partial \tau^{*j}} > 0 \tag{A.5}$$

where the expressions are signed in accordance with Assumption 1. Using these expressions, we next derive that:

$$\overline{W}_{\tau^{*i}} / \overline{W}_{\tau^{*j}} = \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*j}} > 0 \tag{A.6}$$

$$\overline{W}^{*i}_{\tau} / \overline{W}^{*i}_{\tau^{*j}} = \frac{\partial \tilde{p}^w}{\partial \tau} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*j}} < 0 \tag{A.7}$$

$$\overline{W}_{\tau} / \overline{W}_{\tau^{*i}} - \overline{W}^{*j}_{\tau} / \overline{W}^{*j}_{\tau^{*i}} = \overline{W}_{\tau} / \overline{W}_{\tau^{*i}} - \frac{\partial \tilde{p}^w}{\partial \tau} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} = W_p \tilde{p}^w / \overline{W}_{\tau^{*i}} \tag{A.8}$$

$$\overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*i}} - \overline{W}^{*j}_{\tau}/\overline{W}^{*j}_{\tau^{*i}} = \overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*i}} - \frac{\partial \tilde{p}^w}{\partial \tau} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*i}}$$

$$= \left[W^{*i}_{p^{*j}} \left(\frac{1}{\tau^{*i}} \right)^2 \tilde{p}^w / \overline{W}^{*i}_{\tau^{*i}} \right] \left[\frac{\partial \tilde{p}^w}{\partial \tau} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} \right] \tag{A.9}$$

$$\overline{W}_{\tau^{*i}}/\overline{W}_{\tau^{*j}} - \overline{W}^{*i}_{\tau^{*i}}/\overline{W}^{*i}_{\tau^{*j}} = \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*j}} - \overline{W}^{*i}_{\tau^{*i}}/\overline{W}^{*i}_{\tau^{*j}}$$

$$= W^{*i}_{p^{*i}} \left(\frac{1}{\tau^{*i}} \right)^2 \tilde{p}^w / \overline{W}^{*i}_{\tau^{*j}} \tag{A.10}$$

We consider next the first-order conditions of Program *MFNW*. At an MFN-efficient tariff vector, there must exist multipliers $\lambda_1 \geq 0$ and $\lambda_2 \geq 0$ such that:

$$\overline{W}_{\tau} + \lambda_1 \overline{W}^{*1}_{\tau} + \lambda_2 \overline{W}^{*2}_{\tau} = 0 \tag{A.11}$$

$$\overline{W}_{\tau^{*1}} + \lambda_1 \overline{W}^{*1}_{\tau^{*1}} + \lambda_2 \overline{W}^{*2}_{\tau^{*1}} = 0 \tag{A.12}$$

and

$$\overline{W}_{\tau^{*2}} + \lambda_1 \overline{W}^{*1}_{\tau^{*2}} + \lambda_2 \overline{W}^{*2}_{\tau^{*2}} = 0 \tag{A.13}$$

As we observed in the text discussion following Proposition 7, cases (i), (ii) and (iii) correspond to the cases in which the home government, respectively, seeks less, seeks more or achieves its desired trade volume at the given world price. In terms of our representation of government objective functions, these cases correspond to the conditions that: $W_p > 0$, $W_p < 0$ and $W_p = 0$. To characterize the MFN-efficiency frontier, we proceed exhaustively through these three cases.

Lemma A1. *Suppose $W_p > 0$ at an MFN-efficient set of tariffs. Then, for every $i \in \{1,2\}$, and $i \neq j$,*

$$(i) \qquad -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} > -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} > -\frac{\partial \overline{W}^{*i}/\partial \tau^{*i}}{\partial \overline{W}^{*i}/\partial \tau} \text{ and } W^{*i}_{p^{*i}} > 0$$

Proof. Given $W_p > 0$, the first inequality follows directly from Assumption 1′ and (A.8), once it is observed that, in (τ, τ^{*i}) space, the iso-welfare curve of the government of foreign country *ji* is also the iso-p^w locus. To establish the other inequalities, we use the first order

conditions for τ (i.e. (A.11)) and τ^{*i} (i.e. (A.12) or (A.13), as appropriate) to solve for λ_j and λ_i. Using (A.7), these solutions may be written as:

$$\lambda_j = [\overline{W}_{\tau^{*_i}}/\overline{W}^{*j}_{\tau^{*_i}}][\overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}} - \overline{W}_{\tau}/\overline{W}_{\tau^{*_i}}]\Bigg/\left[\frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}} - \overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}}\right] \tag{A.14}$$

$$\lambda_i = [\overline{W}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau^{*_i}}]\left[\overline{W}_{\tau}/\overline{W}_{\tau^{*_i}} - \frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}}\right]\Bigg/\left[\frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}} - \overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}}\right] \tag{A.15}$$

As λ_i must be non-negative and finite, the first inequality established above together with Assumption 1 imply that

$$\frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}} > \overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau} \tag{A.16}$$

which under (A.9) is equivalent to $W^{*i}_{*_i} > 0$.

It remains to show that $-\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau} > -\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau}$. Using (A.14), (A.16) and Assumption 1′, we see that $\lambda_i \geq 0$ requires $-\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau} \geq -\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau}$, and so we have only to eliminate the case of equality. To this end, we use the first order conditions for τ^{*j} and τ^{*i} to solve for λ_j and λ_i. Then using (A.6), we calculate that $_j$ may also be expressed as

$$\lambda_j = [\overline{W}_{\tau^{*_i}}/\overline{W}^{*j}_{\tau^{*_i}}]\left[\overline{W}^{*i}_{\tau^{*_j}}/\overline{W}^{*i}_{\tau^{*_i}} - \frac{\partial\tilde{p}^w}{\partial\tau^{*j}}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}}\right]\Bigg/[\overline{W}^{*j}_{\tau^{*_j}}/\overline{W}^{*j}_{\tau^{*_i}} - \overline{W}^{*i}_{\tau^{*_j}}/\overline{W}^{*i}_{\tau^{*_i}}] \tag{A.17}$$

We next use (A.14) and (A.17) and derive that

$$\left[\frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}} - \overline{W}_{\tau}/\overline{W}_{\tau^{*_i}}\right] = [\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau^{*_j}}][\overline{W}^{*j}_{\tau^{*_j}}/\overline{W}^{*j}_{\tau^{*_i}}][\overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}} - \overline{W}_{\tau}/\overline{W}_{\tau^{*_i}}]$$

$$+[\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau^{*_j}}]\left[\frac{\partial\tilde{p}^w}{\partial\tau^{*j}}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}}\right]\left[\frac{\partial\tilde{p}^w}{\partial\tau}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*i}} - \overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}}\right] \tag{A.18}$$

Let us now suppose that $-\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau} = -\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau}$. Then given (A.16) we see that (A.18) reduces to

$$\frac{\partial\tilde{p}^w}{\partial\tau^{*i}}\Bigg/\frac{\partial\tilde{p}^w}{\partial\tau^{*j}} - \overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau^{*_j}} = 0 \tag{A.19}$$

which under (A.10) requires $W^{*i}_{p^{*_i}} = 0$. But this contradicts our finding above that $W^{*i}_{p^{*^i}} > 0$. Hence, $-\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau} > -\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau}$, and the lemma is proved. □

Lemma A2. *Suppose $W_p<0$ at an MFN-efficient set of tariffs. Then, for every $i\in\{1,2\}$, and $i \neq j$,*

$$(ii)\ -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} < -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} < -\frac{\partial \overline{W}^{*i}/\partial \tau^{*i}}{\partial \overline{W}^{*i}/\partial \tau} \text{ and } W^{*i}_{p^{*_i}} < 0$$

Proof. Given $W_p < 0$, the first inequality follows directly from Assumption 1′ and (A.8). Using (A.15), λ_i non-negative and finite then implies

$$\overline{W}^{*i}_{\tau}/\overline{W}^{*i}_{\tau^{*_i}} > \frac{\partial \tilde{p}^w}{\partial \tau} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*i}}$$

which with (A.9) yields $W_{p^{*_i}}<0$. Next, (A.14) now implies that $-\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau} \geq -\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau}$. Finally, suppose $-\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau} = -\overline{W}_{\tau^{*_i}}/\overline{W}_{\tau}$. Then, using (A.18) we may again derive that (A.19) must hold, whence under (A.10) it follows that $W^{*i}_{p^{*_i}} = 0$, a contradiction. □

Lemma A3. *Suppose $W_p=0$ at an MFN-efficient set of tariffs. Then for every $i\in\{1,2\}$, and $i \neq j$,*

$$(iii)\ -\frac{\partial \overline{W}^{*j}/\partial \tau^{*i}}{\partial \overline{W}^{*j}/\partial \tau} = -\frac{\partial \overline{W}/\partial \tau^{*i}}{\partial \overline{W}/\partial \tau} \gtrless -\frac{\partial \overline{W}^{*i}/\partial \tau^{*i}}{\partial \overline{W}^{*i}/\partial \tau}$$

and there exists $j \in \{1,2\}$ such that $W^{*j}_{p^{*j}}=0$.

Proof. Given $W_p = 0$, the first equality follows directly from (A.8). Consider next the second equality. Using the first equality just derived, the necessary MFN-efficiency condition (A.18) may be rewritten as

$$0 = [\overline{W}^{*j}_{\tau^{*_j}}/\overline{W}^{*j}_{\tau^{*_i}}]\left[\overline{W}^{*j}_{\tau} \Big/ \overline{W}^{*j}_{\tau^{*_j}} - \frac{\partial \tilde{p}^w}{\partial \tau} / \frac{\partial \tilde{p}^w}{\partial \tau^{*j}}\right]\left[\overline{W}^{*i}_{\tau^{*_i}}/\overline{W}^{*i}_{\tau^{*_j}} - \frac{\partial \tilde{p}^w}{\partial \tau^{*i}} \Big/ \frac{\partial \tilde{p}^w}{\partial \tau^{*j}}\right]$$

But the first term is positive, under (A.9) (after reversing the "*i*'s" and "*j*'s") the second term is zero if and only if $W^{*j}_{p^{*_j}} = 0$, and under (A.10) the third term is zero if and only if $W^{*i}_{p^{*_i}} = 0$. Since the second or third term (or both) must be zero, the lemma follows. □

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