

# Feasible Multilateralism and the Effects of Regionalism

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## Abstract

Recent research has underlined the efficiency of the GATT/WTO rules from the standpoint of politically motivated governments, emphasizing that the current multilateral rules are capable of delivering a *politically efficient* equilibrium. Such an equilibrium is, however, *economically inefficient*. Global free trade, in particular, is generally unattainable even in a fully cooperative world, provided that governments have distributive motivations. In such a context, we show that regional trade agreements can help move the world towards a welfare superior equilibrium. The reason is that, as members of regional trade agreements lower trade barriers against one another, they are induced to reduce their multilateral tariffs as well. Once we account for these endogenous changes—and only then—we find that regionalism can raise world welfare even in a fully cooperative (but political) world. We also find, however, that members are likely to gain "too much" from regional integration, thereby harming outsiders.

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**Key Words:** Regionalism, Multilateral Cooperation, Trade Agreements, Economic Efficiency.

## 1 Introduction

The world trading system has experienced significant liberalization since the inception of the General Agreement on Tariffs and Trade (GATT) in 1947. Average *ad valorem* tariffs on manufactured goods, for example, have fallen since

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then from about 40 percent to less than 5 percent. More recently, while keeping cooperation at the multilateral level through continuing negotiations—now under the auspices of the World Trade Organization (WTO), created in 1995 to expand the GATT to new areas—countries have become also increasingly engaged in initiatives of trade liberalization at the regional/preferential level. As a result, there are now over 150 regional trade agreements in force, with several others being currently negotiated worldwide.

In this paper, we analyze the implications of these preferential initiatives of trade liberalization for economic efficiency and global welfare in an environment where, in line with the realities of the world trading system, there is significant cooperation at the multilateral level. In assessing the effects of regionalism, we follow recent political economy research, allowing governments to care about national welfare while also responding to the demands of special interest groups. As Grossman and Helpman (1995a) and Bagwell and Staiger (1999a) point out, these distributive motivations tend to make global free trade—the policy that would maximize aggregate world efficiency—unattainable even in a fully cooperative world, simply because politically motivated governments do not have efficiency as their sole goal. In such a context, an agreement among a subset of countries to eliminate tariffs on imports from one another, as they do when engaging in preferential trade agreements (PTAs), would reduce aggregate trade barriers while promoting trade discrimination. As the regionalism literature has emphasized since Viner (1950), the former effect tends to enhance aggregate efficiency, whereas the latter tends to reduce it. These contradictory forces have been at the center of the unresolved controversies about preferential liberalization.

We show that in a political but fully cooperative world, this key ambiguity regarding the effects of regionalism can be resolved. We find that the forces shaping multilateral cooperation induce members of PTAs to reduce their tariffs on excluded countries, as a response to the trade diversion the preferential blocs would otherwise generate. With lower external tariffs, aggregate restrictions to trade are further reduced while trade discrimination is moderated. We show that these endogenous changes in external tariffs ensure that the formation of preferential trade agreements can enhance aggregate economic efficiency.

Several authors have indicated the inadequacy of the (still) common practice of taking the external tariffs of countries forming PTAs as exogenously given. After all, the benefits and costs of tariffs applied on distinct sources of imports are generally interdependent, and this interdependence can be significant. Richardson (1993) was the first to point out that a free trade agreement would induce members to reduce their external tariffs. Bagwell and Staiger (1999b) termed this positive relationship between tariffs applied to different sources of imports "tariff complementarity." Bond et al. (2003) and Ornelas (2002a) show that the reduction of external tariffs by members of free trade areas tends to be deep enough to enhance trade even between bloc members and non-members. Other authors (e.g. Krugman 1991 and Cadot et al. 1999) suggest that there may be forces pushing for higher external tariffs as well, especially when integration takes the form of a customs union.

So far, however, analyses have been restricted to non-cooperative (multilateral) settings. In this paper, we extend that literature by studying how the formation of PTAs affects external tariffs and global welfare in a cooperative multilateral environment.<sup>1</sup> We show that the tariff complementarity effect generalizes to the important case where there is significant cooperation at the multilateral level.

This paper relates also to the line of research that focuses on the compatibility between preferential and multilateral trade liberalization in political economy settings. Levy (1997) and Krishna (1998), for example, analyze whether the formation of PTAs tends to help or hinder the prospects of global free trade. Interestingly, despite using very distinct frameworks, Levy and Krishna obtain essentially the same result: preferential trade agreements can render global free trade unfeasible. Thus, they regard regionalism as a "stumbling block" to the multilateral freeing trade.

As indicated above, however, politically motivated governments would generally stop short of establishing global free trade even if they fully cooperate with each other. Accordingly, rather than asking whether the formation of PTAs undermines the political feasibility of free trade, as Levy and Krishna do, we take a different approach. First, we characterize a *feasible* multilateral trade agreement, with the feasibility constraint shaped by the governments' political preferences. We then analyze how the formation of PTAs would affect such an agreement. As indicated above, the answer we find contrasts sharply with the results of Levy and Krishna: PTAs tend to improve aggregate world welfare, bringing the multilateral trading system *closer* (in terms of economic efficiency) to global free trade.

On the surface, this result may appear inconsistent with the findings of Bagwell and Staiger (1999a). Focusing on the efficiency properties of the GATT negotiating rules, they show that trade negotiations that follow the principle of reciprocity deliver an efficient multilateral trade agreement, from the perspective of the negotiating governments, if and only if negotiations also abide by the principle of non-discrimination. But since PTAs are discriminatory by nature, according to Bagwell and Staiger (1999a, p. 218), "preferential agreements pose a threat to the efficiency properties of the existing multilateral system."

In the present paper, we take a distinct perspective. As in standard welfare analyses, we focus on *economic* efficiency, rather than on the *political* efficiency emphasized by Bagwell and Staiger. We do not study GATT's negotiation rules either. Instead, we follow Grossman and Helpman (1995a) and simply assume that governments can bargain efficiently, thus reaching an agreement that maximizes their joint payoff. In such a context, PTAs disrupt the governments' fully cooperative equilibrium and lower their joint payoff, as in Bagwell and Staiger's setting. However, politically efficient equilibria are generally *not* economically

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<sup>1</sup>There is a related literature—Bagwell and Staiger (1999b), Bond et al. (2001), Freund (2000) and Levy (1999), among others—that analyzes the relationship between regionalism and multilateralism by focusing on enforcement issues. Our emphasis is distinct. Like Bagwell and Staiger (1999a), Grossman and Helpman (1995a), Krishna (1998) and Levy (1997), we take a long run perspective on multilateral cooperation, abstracting from enforcement issues.

efficient. Accordingly, disturbances to such equilibria may be economically desirable, as we find here to be the case when they arise from the formation of PTAs.

After examining the effects of PTAs on global welfare, we turn to their distributive effects across countries. Departing from the revealed preference argument that governments seek regional integration only if doing so benefits them, we find that a PTA increases the bargaining power of the regional partners, vis-à-vis the outsiders, in multilateral negotiations. Otherwise, the reduction of external tariffs, which the non-member countries receive "for free," would engender a lower payoff for at least one of the governments forming the PTA—and possibly for both.

We show that the necessary change in relative forces induced by a PTA in multilateral negotiations ensures that welfare increases in the PTA countries. That comes, however, at the expense of the countries left out of the arrangement, where welfare falls. Hence, even though regionalism promotes aggregate efficiency, it distributes such gains quite unevenly: PTA members reap *more* than the aggregate benefits generated by the regional bloc, while non-members lose.

The paper is organized as follows. The model is presented in Section 2. In Section 3, we characterize a multilateral cooperative trade agreement, and in Section 4 we assess the effects of trade liberalization and trade discrimination on global welfare. We study the consequences of preferential trade agreements on external tariffs and on aggregate efficiency in Section 5. In Section 6, we consider the distributive consequences of PTAs. We conclude in Section 7.

## 2 Model

### 2.1 Basic Structure

We consider a three-country,  $N$ -good competitive model. We make a "natural importer" assumption under which, for identical prices in all three countries, the natural importer imports the good in question from the other two countries.

Consumers have quasi-linear objective functions of the form  $U = x_0 + \sum_{k=1}^{N-1} u_k(x_k)$ . All goods are produced under constant returns to scale. Goods labeled  $x_1, \dots, x_{N-1}$  require labor and a sector-specific factor to be produced, while good  $x_0$  needs labor only. Defining  $x_0$  as the numeraire, the wage rate is set to unity. Under this structure, sector  $x_0$  absorbs all general equilibrium-type of effects, effectively making the remaining  $N - 1$  sectors independent of each other. This allows us to concentrate the analysis on only one of those sectors. We let the natural importer in such a sector be country 1, and call it Home.

In country  $i$ , the owners of the sector-specific factor employed in the sector under analysis obtain rents represented by  $\Pi_i(p_i)$ ,  $i = 1, 2, 3$ , where  $p_i$  denotes country  $i$ 's domestic price. Supply of that product in country  $i$  is given by  $S_i(p_i) = \Pi'_i(p_i)$  and is positively sloped:  $S'_i(\cdot) > 0$ ,  $i = 1, 2, 3$ . [Throughout the text, " ' " denotes the derivative of univariate functions.] The natural

importer assumption requires  $S_1(p^o) < S_j(p^o)$  for any  $p^o$ ,  $j = 2, 3$ . We assume demand functions are symmetric across countries and negatively sloped:  $D(p_i) = (u')^{-1}(p_i)$ , with  $D'(\cdot) < 0$ ,  $i = 1, 2, 3$ . Home's imports are determined by  $M(p_1) = D(p_1) - S_1(p_1)$ , whereas  $E_j(p_j) = S_j(p_j) - D(p_j)$  defines country  $j$ 's exports,  $j = 2, 3$ . Import function  $M(\cdot)$  is decreasing, while export function  $E_j(\cdot)$  is increasing:  $M'(p) = D'(p) - S'_1(p) < 0$  and  $E'_j(p_j) = S'_j(p_j) - D'(p_j) > 0$ .

## 2.2 Trade Policy Instruments and Market Equilibrium

We focus on import tariffs, abstracting from export subsidies. The disregard of export subsidies is, however, inconsequential, since we will consider that countries choose their multilateral trade policies cooperatively. As Bagwell and Staiger (1999a) show, only net tariffs (i.e., the import tariff minus the correspondent export subsidy) matter for negotiation. Thus, each import tariff can be straightforwardly re-interpreted as its correspondent net tariff.<sup>2</sup>

Denoting Home's (specific) tariff on imports from country  $j$  by  $\tau_j$ , arbitrage conditions link prices in the three countries as follows:

$$p_1 = p_j + \tau_j, \quad j = 2, 3,$$

provided that  $\tau_j$  is not prohibitively high. Moreover, markets must clear, so the equilibrium local price satisfies (using the arbitrage condition)

$$M(\hat{p}) = \sum_{j=2,3} E_j(\hat{p} - \tau_j), \quad (1)$$

where  $\hat{p}$  denotes Home's local equilibrium price.

In the present setting, where no country is "small" in the theoretical sense, there is an incomplete pass-through from tariffs to prices. Thus, if Home increases its tariff against imports from any of the two countries, the effect on Home's local price is positive but lower than the increase in the tariff. This can be seen by totally differentiating the market-clearing condition:

$$\begin{aligned} M'(\hat{p}) \left[ \frac{\partial \hat{p}}{\partial \tau_i} d\tau_i + \frac{\partial \hat{p}}{\partial \tau_j} d\tau_j \right] &= E'_i(\hat{p} - \tau_i) \left[ \left( \frac{\partial \hat{p}}{\partial \tau_i} - 1 \right) d\tau_i + \frac{\partial \hat{p}}{\partial \tau_j} d\tau_j \right] \\ &+ E'_j(\hat{p} - \tau_j) \left[ \frac{\partial \hat{p}}{\partial \tau_i} d\tau_i + \left( \frac{\partial \hat{p}}{\partial \tau_j} - 1 \right) d\tau_j \right], \quad i, j = 2, 3. \end{aligned} \quad (2)$$

Setting  $d\tau_i = 0$ , this expression can be rearranged as

$$\rho_j(\tau_i, \tau_j) \equiv \frac{\partial \hat{p}(\tau_i, \tau_j)}{\partial \tau_j} = \frac{E'_j(\hat{p} - \tau_j)}{E'_i(\hat{p} - \tau_i) + E'_j(\hat{p} - \tau_j) - M'(\hat{p})} \in (0, 1). \quad (3)$$

Since  $\rho_j(\tau_i, \tau_j) < 1$ , Home improves its terms of trade vis-à-vis country  $j$  when it raises  $\tau_j$ . An analogous expression can be derived for  $\rho_i(\tau_i, \tau_j) \equiv \partial \hat{p}(\tau_i, \tau_j) / \partial \tau_i$ .

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<sup>2</sup>We also note that the WTO, which is often viewed as central to promote multilateral cooperation, does not allow export subsidies. The WTO disallows non-tariff trade barriers as well, which are not considered here either.

## 2.3 Governments' Objectives

Governments care about both general economic conditions and distributive issues in their own countries. While there are several possible ways of representing such preferences, here we employ a reduced-form representation that weighs aggregate welfare and producers' surplus. The reason is two fold. First, our focus is not on analyzing the sources of governments' political motivations. Moreover, Baldwin (1987) shows that an objective function that weighs national welfare and producers' surplus can indeed represent the reduced-form of most political economy frameworks.<sup>3</sup> This specification implies that governments effectively behave as if they were more concerned with producers' welfare than with consumers' welfare.

We define national welfare ( $W$ ) as the sum of consumers' surplus, tariff revenue and producers' surplus:<sup>4</sup>

$$W_1(\tau_2, \tau_3) = \int_{\hat{p}(\tau_2, \tau_3)}^{\infty} D(p)dp + \sum_{j=2,3} \tau_j E_j(\hat{p} - \tau_j) + \Pi_1(\hat{p}(\tau_2, \tau_3)), \text{ and}$$

$$W_j(\tau_2, \tau_3) = \int_{\hat{p}(\tau_2, \tau_3) - \tau_j}^{\infty} D(p)dp + \Pi_j(\hat{p}(\tau_2, \tau_3) - \tau_j), j = 2, 3.$$

Governments' payoffs can then be represented as

$$G_1(\tau_2, \tau_3) = W_1(\tau_2, \tau_3) + (\gamma_m - 1)\Pi_1(\tau_2, \tau_3), \text{ and} \quad (4a)$$

$$G_j(\tau_2, \tau_3) = W_j(\tau_2, \tau_3) + (\gamma_e - 1)\Pi_j(\tau_2, \tau_3), j = 2, 3. \quad (4b)$$

Note in these definitions that we assign the same extra weight to producers' surplus,  $\gamma_e - 1 \geq 0$ , in the payoffs of the two exporting countries' governments. This is unessential and assumed mainly to reduce notation. By contrast, those weights are generally distinct from the Home government's extra weight on producers' surplus,  $\gamma_m - 1 \geq 0$ . Thus, we allow the political influence of importers and exporters to differ from one another.

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<sup>3</sup>Baldwin's (1987) result also incorporates the (later-published) influential political economy representation suggested by Grossman and Helpman (1994), where governments are concerned with the well-being of the average voter as well as with campaign contributions received from special interest groups. In that case, Baldwin's reduced-form representation applies when producers are capable of organizing themselves in politically active lobbies and provided that their actions are not fully counteracted by other active lobbies with opposing interests—in which case the government's extra weight on producers' surplus would be nil.

<sup>4</sup>Note that we refer only to welfare related to the production and consumption in the sector under analysis. This independent sectoral analysis is possible because of the separability due to the quasi-linearity of the utility function.

### 3 Multilateral Cooperation

#### 3.1 Non-Cooperative Trade Equilibrium

In the absence of multilateral cooperation, each government implements trade policies without taking into account the consequences for the rest of the world. In such a context, governments attempt to shift the cost of their own restrictive trade policies to foreign countries, typically producing inefficient outcomes. Mutually beneficial trade agreements can eliminate these types of inefficiencies. In this paper, we focus on equilibria characterized by arrangements of that nature. Still, to provide a benchmark that allows us to highlight the inefficiencies that can be eliminated by a multilateral trade agreement—and those that cannot—it is useful to specify first a non-cooperative equilibrium.

In a non-cooperative equilibrium, the Home government chooses tariffs to maximize its individual payoff:

$$\{\tau_2^n, \tau_3^n\} = \arg \max_{\{\tau_2, \tau_3\}} G_1(\tau_2, \tau_3).$$

When evaluated at the equilibrium (and dropping the arguments of  $\rho_3$  for notational ease), the first-order necessary condition (FONC) that characterizes  $\tau_3^n$ ,  $dG_1(\tau_2, \tau_3)/d\tau_3 = 0$ , corresponds then to

$$-D(\hat{p})\rho_3 + \gamma_m S_1(\hat{p})\rho_3 + \tau_2 E_2'(\hat{p} - \tau_2)\rho_3 + \tau_3 E_3'(\hat{p} - \tau_3)(\rho_3 - 1) + E_3(\hat{p} - \tau_3) = 0.$$

Using equation 2 and the market-clearing condition, this expression can be rewritten as

$$(\gamma_m - 1)S_1(\hat{p})\rho_3 + \tau_3 M'(\hat{p})\rho_3 - (\tau_3 - \tau_2)E_2'(\hat{p} - \tau_2)\rho_3 + [(1 - \rho_3)E_3(\hat{p} - \tau_3) - \rho_3 E_2(\hat{p} - \tau_2)] = 0. \quad (5)$$

Assuming that the second-order condition is satisfied, equation 5 implicitly defines Home's non-cooperative tariff against imports from country 3 for any given  $\tau_2$ ,  $\tau_3^n(\tau_2)$ .

Four distinct forces shape  $\tau_3^n(\tau_2)$ . The first is politics. Since a higher  $\tau_3$  raises the domestic price, it benefits the domestic producers. Thus, if the domestic producers are politically more influential than consumers—i.e., if  $\gamma_m > 1$ —they induce increased protection against country 3. This effect is reflected in the first element of equation 5. Note that, for a given  $\gamma_m$ , the domestic industry is more effective in inducing protection the larger is its output.

The second element is equation 5,  $\tau_3 M'(\hat{p})\rho_3 < 0$ , represents the inefficiency caused by the tariff through a reduction in the import volume. This term is unambiguously negative and hence pushes for a lower tariff.

The third term of equation 5,  $-(\tau_3 - \tau_2)E_2'(\hat{p} - \tau_2)\rho_3$ , denotes the effect created by discrimination among distinct sources of imports. Whenever a tariff is altered, it changes the source of some of the imports. In particular, as  $\tau_3$  increases, Home relocates imports from country 3 to country 2. But if  $\tau_3 > \tau_2$ , marginal costs are lower in country 3, since  $\hat{p}_3 = \hat{p} - \tau_3 < \hat{p} - \tau_2 = \hat{p}_2$ . Hence,

in that case the dislocation of imports from country 3 to country 2 corresponds to an inefficient shift to a higher-cost supplier. [Clearly, the opposite happens if  $\tau_3 < \tau_2$ .] This effect corresponds to the well-known trade diversion identified by Viner (1950), and is reflected in the lower tariff proceeds that Home collects when it shifts imports from country 3 to country 2. Naturally, this effect vanishes under the WTO requirement of non-discrimination (MFN treatment).

The last force represented in equation 5 corresponds to terms of trade effects. These motivations correspond to the familiar "optimal tariff" argument identified by Johnson (1953-4)—although we consider a three-, rather than Johnson's two-country, environment. Here, because  $\rho_3 < 1$ , an increase in  $\tau_3$  is not fully passed to Home's domestic price, thereby implying a fall in  $\hat{p}_3 = \hat{p} - \tau_3$ . Accordingly, Home experiences a terms of trade improvement against country 3. Conversely,  $\hat{p}_2 = \hat{p} - \tau_2$  rises with a higher  $\tau_3$ , deteriorating Home's terms of trade vis-à-vis country 2.

An expression analogous to equation 5 can be obtained for  $\tau_2^n(\tau_3)$ . The two equations can then be straightforwardly solved for Home's optimal non-cooperative tariffs  $\{\tau_2^n, \tau_3^n\}$ .

### 3.2 Cooperative Trade Equilibrium

We describe now a cooperative multilateral trade equilibrium. As Grossman and Helpman (1995a), we assume governments can bargain efficiently over their trade policies. Since the marginal utility of income is fixed at unity in all three countries, the cooperative tariffs are unaffected by the distribution of income across countries. As a result, the ensuing cooperative equilibrium entails a set of tariffs that simply maximizes the government's joint payoffs.<sup>5</sup> This set of *politically efficient tariffs* thus satisfies

$$\{\tau_2^{pe}, \tau_3^{pe}\} = \arg \max_{\{\tau_2, \tau_3\}} \sum_{i=1,2,3} G_i(\tau_2, \tau_3). \quad (6)$$

Making use of equation 5, the FONC that characterizes  $\tau_3^{pe}$  can be written, when evaluated at the equilibrium, as

$$\begin{aligned} \sum_{i=1,2,3} \frac{dG_i(\tau_2, \tau_3)}{d\tau_3} &= (\gamma_m - 1)S_1(\hat{p})\rho_3 + \tau_3 M'(\hat{p})\rho_3 - (\tau_3 - \tau_2)E_2'(\hat{p} - \tau_2)\rho_3 \\ &+ [(1 - \rho_3)E_3(\hat{p} - \tau_3) - \rho_3 E_2(\hat{p} - \tau_2)] + [E_2(\hat{p} - \tau_2) + (\gamma_e - 1)S_2(\hat{p} - \tau_2)]\rho_3 \\ &- [E_3(\hat{p} - \tau_3) + (\gamma_e - 1)S_3(\hat{p} - \tau_3)](1 - \rho_3) = 0, \end{aligned}$$

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<sup>5</sup>The multilateral trade agreement may specify also transfers among governments, which may be necessary especially if there are significant asymmetries in countries' bargaining powers. Transfers affect the distribution of gains in the cooperative equilibrium, but have no effect on either cooperative policies or aggregate welfare. Accordingly, we postpone the introduction of transfers until Section 6, where we analyze the distributive consequences of regionalism.



or equivalently as

$$[(\gamma_m - 1)S_1(\hat{p})\rho_3 + (\gamma_e - 1)S_2(\hat{p} - \tau_2)\rho_3 - (\gamma_e - 1)S_3(\hat{p} - \tau_3)(1 - \rho_3)] \\ + \tau_3 M'(\hat{p})\rho_3 - (\tau_3 - \tau_2)E'_2(\hat{p} - \tau_2)\rho_3 = 0. \quad (7)$$

Assuming that the second-order condition is satisfied (in the next section we provide a condition to ensure that it is), equation 7 implicitly defines Home's politically efficient tariff against imports from country 3 for any given  $\tau_2$ ,  $\tau_3^{pe}(\tau_2)$ .

Three distinct forces shape  $\tau_3^{pe}(\tau_2)$ . The first is politics. Since  $\rho_3 \in (0, 1)$ , producers competing with country 3's firms gain, while country 3's own producers lose from a higher  $\tau_3$ . Thus, whereas the former pushes for more protection against imports from country 3, the latter does the opposite. Hence, in contrast with a non-cooperative equilibrium, under multilateral cooperation foreign countries' politically organized groups become represented in the policy-making process. This political dimension of multilateral cooperation is reflected in the first square bracket of equation 7. Politics' net effect on  $\tau_3^{pe}$  depends on the relative political strengths of the distinct groups, which in turn depend on the political parameters  $\gamma_m$  and  $\gamma_e$  and on the correspondent stakes: everything else constant, the producers in a country are more important in shaping policies the larger is their output, relative to the output of producers in the other countries.

The other two forces shaping  $\tau_3^{pe}(\tau_2)$  represent, respectively, the inefficiency caused by the tariff on the volume of imports and the (in)efficiency caused by (an increase) a reduction in the discrimination between the two sources of imports. These forces are unaffected by multilateral cooperation, and therefore represented identically in FONCs 7 and 5.

By contrast, the terms of trade motivations present in the non-cooperative equilibrium (equation 5) are absent in the cooperative equilibrium (equation 7). This should come as no surprise. After all, as Grossman and Helpman (1995a) and Bagwell and Staiger (1999a) make clear, terms of trade manipulations correspond to "beggar-thy-neighbor" policies, and as such they are neutralized when countries set trade policies cooperatively.

An expression analogous to equation 7 can be obtained for  $\tau_2^{pe}(\tau_3)$ . The two equations can then be straightforwardly solved for Home's politically efficient tariffs  $\{\tau_2^{pe}, \tau_3^{pe}\}$ .

The important point to note here is that politically efficient tariffs are *not* economically efficient. Tariffs that maximize global efficiency are equivalent to tariffs that maximize world aggregate welfare. That is, they solve problem 6 when  $\gamma_m = \gamma_e = 1$ :

$$\{\tau_2^*, \tau_3^*\} = \arg \max_{\{\tau_2, \tau_3\}} \Omega(\tau_2, \tau_3) \equiv \arg \max_{\{\tau_2, \tau_3\}} \sum_{i=1,2,3} W_i(\tau_2, \tau_3).$$

Using FONC 7, we then find that tariffs  $\{\tau_2^*, \tau_3^*\}$  must satisfy

$$\begin{cases} \tau_2^* M'(\hat{p}) - (\tau_2^* - \tau_3^*) E'_3(\hat{p} - \tau_3^*) = 0 \\ \tau_3^* M'(\hat{p}) - (\tau_3^* - \tau_2^*) E'_2(\hat{p} - \tau_2^*) = 0. \end{cases}$$

Unsurprisingly, the solution of this system has  $\tau_2^* = \tau_3^* = 0$ , so global economic efficiency is achieved only under free trade. Lemma 1 follows from these observations.

**Lemma 1** *If governments have distributional concerns (i.e., if  $\gamma_m > 1$  and/or  $\gamma_e > 1$ ),  $\{\tau_2^{pe}, \tau_3^{pe}\} \neq \{\tau_2^*, \tau_3^*\} = \{0, 0\}$ . Thus, politically efficient tariffs are economically inefficient.*

Hence, whereas a cooperative multilateral trade agreement generally improves upon a non-cooperative equilibrium, it delivers an outcome that is optimal from the perspective of its negotiators—namely, governments with distributional concerns—rather than from the perspective of economic efficiency. In such a second-best context, developments in the world trading system that alter the outcome of the cooperative multilateral equilibrium, as e.g. the creation of preferential trade agreements, may then be desirable from an efficiency perspective. We evaluate this possibility in the remainder of the paper.

Clear-cut results are obtainable, however, only in a more restricted setting. Accordingly, we specialize the subsequent analysis to a linear version of the present model. While this specialization—obviously—limits the generality of the ensuing results, it is nonetheless enough for the main purpose of this paper: to show that preferential trade agreements *can* improve upon a fully cooperative multilateral equilibrium. The linear version of the model specializes the previous framework as follows:  $D(p_i) = A - bp_i$ ,  $S_1(p_1) = cp_1$  and  $S_j(p_j) = dp_j$ ,  $j = 2, 3$ , where  $\{A, b, c, d\}$  are strictly positive constants and  $d > c$ , consistently with the natural importer assumption. It follows that  $M' = -b - c$ ,  $E' = d + b$  and, from equation 3,  $\rho_2 = \rho_3 = \frac{b+d}{3b+c+2d} \in (\frac{1}{3}, \frac{1}{2})$ . Since now  $\rho_3$  and  $\rho_2$  are constant and equal to each other, we simplify notation henceforth by defining  $\rho \equiv \rho_2 = \rho_3$ .

## 4 Trade Liberalization vs. Trade Discrimination

The controversies regarding preferential liberalization stem from the ambiguous character of the changes it inflicts on the global trading environment. Thus, it is helpful to begin by identifying the trade-offs preferential trade agreements entail for global efficiency.

A PTA, while promoting trade liberalization, also creates trade discrimination. The former is normally viewed as a positive effect, whereas the latter is typically considered an undesirable consequence. In the present framework, trade liberalization and trade discrimination display these characteristics too: everything else constant, the former (latter) improves (decreases) world welfare. Defining the degree of trade discrimination as  $\Delta \equiv \tau_j - \tau_i \geq 0$  and the degree of trade restrictiveness as  $\Upsilon \equiv \tau_j + \tau_i$ , for  $i, j = 2, 3$ ,  $i \neq j$ , the following lemma proves this claim.

**Lemma 2** *Everything else equal, world welfare decreases when the degree of either trade discrimination or trade restrictiveness increases. That is,  $d\Omega/d\Delta \leq 0$  and  $d\Omega/d\Upsilon \leq 0$ , with strict inequality if  $\Delta > 0$  and  $\Upsilon > 0$ , respectively.*

**Proof.** See Appendix. ■

Lemma 2 outlines the standard welfare ambiguity of preferential trade agreements. By reducing aggregate restrictions to trade, PTAs tend to increase world welfare; by promoting trade discrimination, they tend to reduce world welfare. We must, however, recognize that neither  $\Upsilon$  nor  $\Delta$  is exogenous. In the present framework, a PTA between Home and, say country 2, would require  $\tau_2 = 0$ . But under that constraint, Home's politically efficient tariff against imports from country 3 would tend to change as well. Hence, whereas the introduction of a PTA constrains one dimension of both  $\Upsilon$  and  $\Delta$ , governments will generally want to adjust the unconstrained dimensions of  $\Upsilon$  and  $\Delta$  to the new equilibrium. When assessing the global welfare effects of preferential arrangements, one must account for these induced equilibrium changes.

In the old regionalism literature—as well as in some recent contributions—endogenous adjustments in external tariffs were commonly disregarded. In that context, several authors have suggested that the negative aspect of PTAs (trade discrimination) would tend to prevail over their positive aspect (trade liberalization). A similar result arises here: if the tariff applied on one import source is kept fixed, world welfare is greater under non-discrimination (when the other tariff is set at the same level) than under full discrimination (when the other tariff is eliminated). Yet a departure from uniform tariffs increases world welfare if the resulting degree of trade discrimination is sufficiently small. The following proposition proves these claims.

**Proposition 1** *Starting from a non-discriminatory trade regime with strictly positive tariffs and keeping one of the tariffs constant:*

- i. A small reduction in the other tariff enhances global welfare: for any  $\tau$ ,  $\Omega(\tau_i, \tau) > \Omega(\tau, \tau)$  if  $\tau_i = \lim_{\varepsilon \rightarrow 0} \tau - \varepsilon$ .*
- ii. The elimination of the other tariff reduces global welfare: for any  $\tau$ ,  $\Omega(0, \tau) < \Omega(\tau, \tau)$ .*

**Proof.** See Appendix. ■

Proposition 1 shows that preferential trade liberalization improves world efficiency only if discrimination does not increase "too much." Starting from non-discriminatory tariffs, a small enough reduction in one tariff, while keeping the other fixed, enhances world welfare. Eventually, however, the cost of a further rise in discrimination overcomes the gains from additional trade liberalization. This result underlines the potential harm of discriminatory schemes of trade liberalization emphasized in the regionalism literature.

On the surface, the proposition is also suggestive that the GATT's rules for preferential liberalization may be inappropriate. Under its Article XXIV, the GATT allows countries to deviate from MFN treatment when forming free trade areas or customs unions, but it requires countries to eliminate (or at least "substantially reduce") trade barriers against each other as a precondition.

tion for preferential liberalization.<sup>6</sup> Since Proposition 1 asserts that preferential arrangements establishing internal free trade among their members lower aggregate efficiency, one may then be tempted to deem GATT's requirement of complete internal liberalization responsible for creating inefficiencies in preferential schemes of trade liberalization.<sup>7</sup> However, one must note that Proposition 1 holds *under the assumption of fixed external tariffs*.

As indicated in the Introduction, several authors have shown that countries forming PTAs have incentives to reduce their external tariffs. And even though analyses of the endogenous changes in external tariffs have so far largely disregarded cooperation at the multilateral level, we show in the next section that a similar outcome can be expected under multilateral cooperation. As we will see, once we account for the endogenous changes in external tariffs, the expected welfare impact of a PTA is critically altered.

Since the very basic idea of regional integration is to *liberalize* trade beyond the levels achieved by multilateral cooperation, we assume henceforth that multilateral cooperation alone is incapable of delivering global free trade—i.e., we require politically efficient tariffs to be strictly positive. This assumption also makes the analysis consistent with the pervasive anti-trade bias observed in trade policies throughout the world (Rodrik 1995). We disregard as well the less interesting case in which cooperative tariffs are prohibitive. These conditions amount to imposing constraints on the political parameters  $\gamma_e$  and  $\gamma_m$ .

**Condition 1** *Politically efficient MFN tariffs are strictly positive and non-prohibitive. This is equivalent to imposing the following constraints on the political parameters:*

- i.  $(\gamma_e - 1) < \lambda(\gamma_m - 1)$ , where  $\lambda \equiv \frac{c\rho}{(1-2\rho)d} < 1$ , and
- ii.  $2c\rho^2(\gamma_m - 1) + d(1 - 2\rho)^2(\gamma_e - 1) < (b + c)\rho$ .

**Proof.** See Appendix. ■

Levy (1999) shows that, if importing-competing and export-oriented industries had the same political influence over trade policies, a fully cooperative multilateral equilibrium would be characterized by import *subsidies*. Condition 1.i defines the exact degree by which the political influence of import-competing industries need to overcome the political influence of export-oriented ones to prevent this rarely observed outcome. Condition 1.ii, in turn, simply rules out prohibitive cooperative tariffs. It corresponds to the second-order condition for an interior solution of politically efficient MFN tariffs.

<sup>6</sup>GATT's Article XXIV also disallows members to increase their external tariffs upon formation of the PTA. However, as we show in the next section, this condition is immaterial, since in equilibrium the integrating countries will tend to reduce their external tariffs.

<sup>7</sup>We must, however, note that GATT's article XXIV has hardly been enforced. In fact, the degree of implementation varies significantly across the more than 150 agreements formally in force. While in some cases members follow a policy of strict internal free trade (as e.g. in the Andean Community), in others internal trade barriers have barely been affected by the formal creation of the bloc (as for example in the Latin America Integration Association). Still, from a normative standpoint, it is useful to consider the appropriateness of GATT's rules for preferential liberalization.

## 5 Regionalism under Multilateral Cooperation

The recent spread of regionalism takes place in a world characterized by significant cooperation at the multilateral level. But PTAs restrict their members' set of available trade instruments, thereby affecting the outcome of multilateral negotiations, as well as their welfare implications. We are now able to analyze these effects.

We begin by demonstrating how, in a cooperative multilateral equilibrium, the reduction of the tariff on one source of imports alters the tariffs imposed on alternative sources. For concreteness, we henceforth refer to country 2 as Home's potential PTA partner, letting country 3 represent the excluded country. Thus, we evaluate how  $\tau_3^{pe}$  evolves as  $\tau_2$  changes—that is, we study the function  $\tau_3^{pe}(\tau_2)$ .

**Proposition 2** *If Home's tariff on imports from country 2 ( $\tau_2$ ) falls, its politically efficient tariff on imports from country 3 ( $\tau_3^{pe}$ ) falls as well, albeit to a lesser extent. Specifically,  $\rho/(1-\rho) < d\tau_3^{pe}(\tau_2)/d\tau_2 < 1$ .*

**Proof.** Specializing FONC 7 to the linear case, we obtain  $\tau_3^{pe}$  as an implicit function of  $\tau_2$ :

$$(\gamma_m - 1)S_1(\hat{p})\rho + (\gamma_e - 1)S_2(\hat{p} - \tau_2)\rho - (\gamma_e - 1)S_3(\hat{p} - \tau_3^{pe}(\tau_2))(1 - \rho) - \tau_3^{pe}(\tau_2)(b + c)\rho - [\tau_3^{pe}(\tau_2) - \tau_2](b + d)\rho \equiv 0. \quad (8)$$

It is then straightforward to calculate  $d\tau_3^{pe}(\tau_2)/d\tau_2$  from the expression above:

$$\frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} = \frac{\rho}{k} [(\gamma_m - 1)c\rho - 2d(\gamma_e - 1)(1 - \rho) + (b + d)], \quad (9)$$

where the constant  $k$  is defined as

$$k \equiv - \sum_j d^2 G_j / d\tau_3^2 = (2b + c + d)\rho - (\gamma_m - 1)c\rho^2 - (\gamma_e - 1)[(1 - \rho)^2 + \rho^2]d. \quad (10)$$

Now, suppose the first part of the proposition does not hold, so  $d\tau_3^{pe}(\tau_2)/d\tau_2 \leq \rho/(1 - \rho)$ . If we use equations 9 and 10, we can rewrite this inequality as

$$[(\gamma_m - 1)c\rho - 2d(\gamma_e - 1)(1 - \rho) + (b + d)](1 - \rho) \leq (2b + c + d)\rho - (\gamma_m - 1)c\rho^2 - (\gamma_e - 1)[(1 - \rho)^2 + \rho^2]d.$$

Since  $(b + d)(1 - \rho) = (2b + c + d)\rho$ , this expression can be rewritten as

$$(\gamma_m - 1)c\rho \leq (\gamma_e - 1)[(1 - \rho)^2 - \rho^2]d,$$

or simply as

$$(\gamma_e - 1) \geq \frac{c\rho}{(1 - 2\rho)d}(\gamma_m - 1).$$

This contradicts Condition 1.i. Hence,  $d\tau_3^{pe}(\tau_2)/d\tau_2 > \rho/(1 - \rho)$ .

Suppose now that  $d\tau_3^{pe}(\tau_2)/d\tau_2 \geq 1$ . If we use equations 9 and 10, we can rewrite this inequality as

$$\begin{aligned} & [(\gamma_m - 1)c\rho - 2d(\gamma_e - 1)(1 - \rho) + (b + d)]\rho \\ & \geq (2b + c + d)\rho - (\gamma_m - 1)c\rho^2 - (\gamma_e - 1)[(1 - \rho)^2 + \rho^2]d. \end{aligned}$$

Rearranging this expression, we obtain

$$2c\rho^2(\gamma_m - 1) + d(1 - 2\rho)(\gamma_e - 1) \geq (b + c)\rho.$$

This contradicts Condition 1.ii. Hence,  $d\tau_3^{pe}(\tau_2)/d\tau_2 < 1$ . ■

Proposition 2 generalizes the tariff complementarity effect previously identified in non-cooperative settings to a cooperative environment. Tariff complementarity is produced here by a combination of forces that reflect the distinct impacts of a lower  $\tau_2$  on the various factors shaping  $\tau_3^{pe}$ . Note first that, everything else constant, a lower  $\tau_2$  increases  $S_2$  while reducing  $S_1$  and  $S_3$ . Since the interests of producers are represented in  $\tau_3^{pe}$  proportionally to their stakes in world production, a lower  $\tau_2$  then makes the support of the domestic producers for a higher  $\tau_3$  less effective. This effect corresponds to the first term inside the square bracket in equation 9. Likewise, a lower  $\tau_2$  makes the political support from country 2 producers for a higher  $\tau_3$  more effective, while reducing the weight of the opposition from country 3 producers to a higher  $\tau_3$ . These last two effects are combined in the second term inside the square bracket of equation 9.

The inefficiency generated by  $\tau_3$  on the volume of imports is unaffected by changes in  $\tau_2$ . By contrast, changes in  $\tau_2$  alter the inefficiency costs due to trade discrimination. With a lower  $\tau_2$ , any increase in  $\tau_3$  promotes additional relocation of production from low-cost to high-cost suppliers, amplifying trade diversion. Hence, a lower  $\tau_2$  raises the cost of increasing  $\tau_3$ . This effect corresponds to the last term in parenthesis in equation 9.

Despite the presence of forces pushing to distinct directions, Condition 1 renders Proposition 2 unambiguous. The condition essentially "calibrates" the relative sizes of parameters  $\gamma_m$  and  $\gamma_e$  to make the politically efficient equilibrium compatible with the widely observed anti-trade bias in trade policies. Condition 1 thus enlarges the significance of the forces stemming from the importers' political power and from the prospect of inefficiencies due to trade diversion, as compared with the forces stemming from the exporters' political power. As a result, it unambiguously delivers tariff complementarity.<sup>8</sup>

We are now ready to evaluate the welfare effects of a preferential trade agreement. Proposition 1 shows that eliminating the tariff on one source of imports decreases world welfare if the tariff applied on competing import sources is kept fixed. Proposition 2 shows, however, that in a cooperative multilateral environment, the elimination of the tariff on one source of imports induces a

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<sup>8</sup>In fact, it is easy to check from the proofs of Condition 1 and Proposition 2 that  $d\tau_3^{pe}(\tau_2)/d\tau_2 > \rho/(1 - \rho)$  if and only if  $\tau_3^{pe} > 0$ .

reduction in the tariff applied on competing import sources. It remains to be seen whether this endogenous reduction of external tariffs is sufficient to improve global welfare. The next proposition shows that this is indeed the case.

**Proposition 3** *When countries choose multilateral trade policies cooperatively and Home forms a PTA with country 2, setting  $\tau_2 = 0$ , its external tariff against imports from country 3 falls to  $\tau_3^{pe}(0)$ . Under this new set of tariffs, global welfare is enhanced:  $\Omega(0, \tau_3^{pe}(0)) > \Omega(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$ .*

**Proof.** Note first that  $\Omega(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) = \Omega(0, \tau_3^{pe}(0)) + \int_0^{\tau_2^{pe}} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2$ . Hence, the PTA enhances global welfare if and only if  $\int_0^{\tau_2^{pe}} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2 < 0$ . This inequality is satisfied, in particular, if  $d\Omega(\tau_2, \tau_3^{pe}(\tau_2))/d\tau_2 < 0$  for all  $\tau_2 \geq 0$ . We show here that this sufficient condition holds.

Using the calculations from the proof of Proposition 1, we find

$$\begin{aligned} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} &= \frac{\partial\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{\partial\tau_2} + \frac{\partial\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{\partial\tau_3} \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \\ &= -[(b+c)\tau_2 + (b+d)(\tau_2 - \tau_3^{pe}(\tau_2))] \rho \\ &\quad - [(b+c)\tau_3^{pe}(\tau_2) + (b+d)(\tau_3^{pe}(\tau_2) - \tau_2)] \rho \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2}. \end{aligned} \quad (11)$$

After some manipulation, we note that this expression is negative if and only if

$$\tau_3^{pe}(\tau_2) \left[ b + d - (2b + c + d) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right] < \tau_2 \left[ b + c + (b + d) \left( 1 - \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right) \right].$$

Since  $d\tau_3^{pe}(\tau_2)/d\tau_2 < 1$  from Proposition 2, the right-hand side of this inequality is positive for any  $\tau_2 \geq 0$ . But note that its left-hand side is negative, since

$$\frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} > \frac{b + d}{2b + c + d} = \frac{\rho}{1 - \rho} \quad (12)$$

from Proposition 2. Hence, world welfare increases with the PTA. ■

Thus, whereas a PTA with fixed external tariffs reduces aggregate welfare, Proposition 3 shows that the tariff complementarity generated under multilateral cooperation reverses that outcome: external tariffs fall with the creation of the PTA deeply enough—in the sense of satisfying requirement 12—to enhance global efficiency. The intuition for this result is as follows. Members of PTAs, by reducing tariffs against outside countries as they liberalize reciprocally, moderate trade discrimination while promoting trade liberalization to levels that would otherwise not be politically feasible. In doing that, they lessen the inefficiencies from trade diversion and amplify trade creation. As a result, levels of global welfare that could not be achieved under strict non-discrimination become feasible under regionalism.

From a normative standpoint, this result redeems GATT's Article XXIV. Although historically the article has not been effectively enforced, the following proposition suggests that it should.

**Proposition 4** *When countries choose multilateral trade policies cooperatively and Home forms a PTA with country 2, aggregate efficiency rises with the degree of internal liberalization in the PTA:  $\Omega(\tau_2'', \tau_3^{pe}(\tau_2'')) > \Omega(\tau_2', \tau_3^{pe}(\tau_2'))$  for any  $\tau_2', \tau_2''$  such that  $\tau_2' > \tau_2'' \geq 0$ .*

**Proof.** From the proof of Proposition 3, we know that  $d\Omega(\tau_2, \tau_3^{pe}(\tau_2))/d\tau_2 < 0$  for all  $\tau_2 \geq 0$ , so  $\int_{\tau_2''}^{\tau_2'} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2 < 0$ . Then, since  $\Omega(\tau_2', \tau_3^{pe}(\tau_2')) = \Omega(\tau_2'', \tau_3^{pe}(\tau_2'')) + \int_{\tau_2''}^{\tau_2'} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2$ , the result follows immediately. ■

Proposition 4 shows that any internal liberalization is beneficial once we account for the endogenous changes in external tariffs. Moreover, the effect on aggregate efficiency is greater, the deeper is internal liberalization. Hence, regionalism would contribute the most to economic efficiency if trade within blocs were fully liberalized, as GATT's Article XXIV proposes.

It is also worth analyzing how political economy factors affect the preceding results. After all, global free trade is not achievable through multilateral cooperation precisely because governments respond to the pressures of protectionist groups. But as Proposition 5 shows, the more responsive governments are to import-competing sectors, the stronger the tariff complementarity effect and, in turn, the *more* effective is regionalism in promoting economic efficiency.

**Proposition 5** *When countries choose multilateral trade policies cooperatively, an increase in the influence of importing-competing industries on the policy-making process, as represented by parameter  $\gamma_m$ :*

- i. raises the politically efficient tariffs;*
- ii. deepens the tariff complementarity effect;*
- iii. magnifies the positive effect of a PTA on aggregate economic efficiency.*

**Proof.** See Appendix. ■

It is often heard in policy circles and among news commentators that protectionist forces have become more influential in recent years, keeping governments from advancing multilateral negotiations aimed at further liberalizing global trade. This would certainly represent unpleasant news for the multilateral trading system. However, even if this assessment is correct, the harmful consequences of such a trend would be at least partially neutralized by the regionalism trend. As Proposition 5 indicates, the beneficial effects of preferential trade agreements are greater precisely when governments are more responsive to the interests of import-competing industries. This result thus suggests that the regionalism boom may be taking place exactly when it is most needed.

## 6 Distributive Effects of Regionalism

In this section, we study how a PTA affects the distribution of welfare across countries. We begin by noting that a regional trading bloc may alter the balance of forces in multilateral negotiations. In fact, increased bargaining power



in international negotiations is a routine justification for the formation of regional trade agreements. In the present setting, the simplest way of representing changes in bargaining powers is by allowing transfers (possibly) specified in the multilateral agreement to depend on the existence of PTAs.<sup>9</sup> As far as equilibrium allocations and *aggregate* welfare are concerned, transfers are immaterial, but they affect welfare in individual countries.<sup>10</sup>

Transfers add to national income; thus, they enter additively in the governments' payoff. In the absence of preferential agreements, we denote the transfers as  $T_i$ ,  $i = 1, 2, 3$ ; when countries 1 and 2 form a regional trading bloc, we refer to them as  $T_i^R$ ,  $i = 1, 2, 3$ . In each case, they need to balance, so  $\sum_i T_i = 0$  and  $\sum_i T_i^R = 0$ .

To analyze the distribution of gains generated by regional integration, we need to expand the model to explain how a PTA affects the transfers specified in the multilateral agreement. We do so while trying to keep the extra structure to a minimum. Thus, recognizing that the formation of a PTA is voluntary, we simply use the revealed preference argument that the PTA governments must jointly gain with the integration process.<sup>11</sup> This argument implies that the trading bloc hurts the government of the excluded country, since the PTA represents a departure from the politically efficient equilibrium, where the joint payoff of all governments is maximized. Note, however, that while such a revealed preference argument has direct implications for the payoffs of *governments*, its implications for countries' *welfare* are by no means immediate.

In principle, governments may gain by forming a PTA in two distinct ways. First, they may benefit from the changes in tariffs induced by the agreement. Furthermore, the PTA may increase their bargaining power vis-à-vis the outside country in multilateral negotiations.<sup>12</sup>

We find, however, that when governments set their multilateral tariffs cooperatively, the tariff changes induced by a PTA hurt the member governments. As a result, to conclude a preferential agreement, governments must derive benefits from increased bargaining power in the multilateral arena that are large enough to compensate them for the losses due to the tariff changes.

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<sup>9</sup>Transfers are arguably common in multilateral negotiations, at least if they are not interpreted literally. For example, the TRIPS agreement can be interpreted as a transfer from developing to developed countries, which the latter required from the former as a condition for liberalization in their agriculture and textile sectors during the GATT's Uruguay Round.

<sup>10</sup>International transfers do not constitute the only way to redistribute welfare across countries without altering the equilibrium allocation. In fact, as Grossman and Helpman (1995a) show, governments can mimic any international transfer by adjusting import tariffs and export subsidies so that the correspondent *net* tariffs (and thus domestic prices) remain unaltered. Since we rule out export subsidies, we use international transfers to study distributive effects across countries. But one would reach qualitatively identical conclusions by allowing export subsidies in addition to, or in place of, international transfers.

<sup>11</sup>One may want to require instead that *each* government gains with the PTA to make it politically viable. This stronger condition is, however, unnecessary for the results that follow.

<sup>12</sup>A PTA may involve as well gains of "non-economic" nature for its members. Schiff and Winters (1998), for example, suggest that PTAs may be created as insurance against military conflicts, while Ornelas (2002b) argues that governments may seek free trade agreements to improve their reelection prospects. These issues are, however, beyond the scope of this paper.

To prove this claim, we first show that, *if transfers were not available* but multilateral cooperation was maintained, a PTA would benefit the *outside* government while hurting the integrating governments.

**Lemma 3** *When countries choose multilateral trade policies cooperatively but transfers among them are infeasible, a PTA benefits the government of the outside country but reduces the joint payoff of the two integrating countries. That is,  $G_3(0, \tau_3^{pe}(0)) > G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$  and  $\sum_{i=1,2} G_i(0, \tau_3^{pe}(0)) < \sum_{i=1,2} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$ .*

**Proof.** See Appendix. ■

This result follows because country 3's terms of trade ( $\hat{p}_3 = \hat{p} - \tau_3$ ) improves with the PTA. Along with the elimination of  $\tau_2$  (which reduces  $\hat{p}$ ), the PTA provokes also a "large" fall in  $\tau_3$ , in the sense that it more than offsets the negative effect from discrimination on  $\hat{p}_3$ . Country 3's terms of trade and welfare then improve with the PTA. Since the government places an extra weight on producers' surplus, it perceives this gain as being even greater.<sup>13</sup>

Thus, it follows from Lemma 3 that a PTA must reshape the balance of power among countries in multilateral negotiations, through changes in the multilateral transfers, to become attractive for its member governments. To make the PTA politically viable, the minimum condition that these changes need to satisfy is

$$\sum_{i=1,2} G_i(0, \tau_3^{pe}(0)) + \sum_{i=1,2} T_i^R \geq \sum_{i=1,2} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + \sum_{i=1,2} T_i.$$

Since transfers must balance in equilibrium under each trade regime, this expression can be rewritten as

$$T_3^R - T_3 \leq \sum_{i=1,2} G_i(0, \tau_3^{pe}(0)) - \sum_{i=1,2} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})). \quad (13)$$

The right-hand side of this expression is negative from Lemma 3. Hence, in a cooperative equilibrium, the outside country must receive less (pay more) in transfers from (to) the other two countries with the PTA in effect than otherwise.

These required changes in the multilateral tariffs allow us to infer the welfare consequences of a PTA within and outside the trading bloc, as we now show.

**Proposition 6** *Under multilateral cooperation, a PTA increases aggregate welfare in its member countries but reduces welfare in the outside country.*

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<sup>13</sup>Note that the restriction of the analysis to a sector in which one of the integrating countries is the natural importer is immaterial. In fact, in sectors in which Home is the natural importer, the government of the partner country benefits even more than the government of the outside country does. Nevertheless, Lemma 3 shows that the member governments' *joint* payoff must fall with the PTA if transfers are not available. The situation is analogous in sectors where Home's PTA partner is the natural importer. In sectors in which the outside country is the natural importer, the PTA is ineffectual.

**Proof.** See Appendix. ■

Proposition 6 establishes that any preferential trade agreement—whose member governments are willing to form—will raise welfare inside the bloc but reduce welfare outside it. The line of reasoning proceeds as follows. Denote by  $Y$  the change in the payoff of country 3's government due to the new tariff levels introduced by the PTA; from Lemma 3,  $Y > 0$ . But since the PTA constitutes a departure from the politically efficient equilibrium, the new tariffs reduce the (joint) payoff of the governments of countries 1 and 2 by *more* than  $Y$ —say by  $Y + Z$ ,  $Z > 0$ . If those governments are willing to form the PTA, it must then be because the arrangement increases their bargaining power enough in multilateral negotiations; that is, their multilateral transfers must increase by at least  $Y + Z$ . Now, it follows from the discussion of Lemma 3 (or directly from its proof) that, while the new tariffs raise welfare in country 3, the increase is no greater than  $Y$  (exactly by  $Y$  iff  $\gamma_e = 1$ ). If we subtract from this gain the loss in transfers due to the PTA, we then find that the welfare change in the excluded country is, in that country's best scenario (when  $\gamma_e = 1$ ), equal to  $Y - (Y + Z) = -Z < 0$ . By contrast, since world welfare expands (Proposition 3), the change in the integrating countries' aggregate welfare due to the PTA is no less than  $Z > 0$ .

This result indicates, therefore, that governments will not push their countries into harmful agreements *because* of their distributional concerns, as often suggested in the regionalism literature—see for example Grossman and Helpman (1995b). In fact, although governments' preferences are not aligned with social welfare in their countries, a government will engage in such an arrangement only when it also benefits the country as a whole. Such benefits come, however, at the expense of the countries left out of the agreement.

## 7 Concluding Remarks

We analyze in this paper the implications of preferential trade liberalization for economic efficiency. In recognition of the realities of the world trading system, the analysis is conducted under the assumption that countries cooperate with each other when choosing their multilateral trade policies.

We show that the "tariff complementarity" identified by previous authors in non-cooperative settings, which implies that external tariffs should fall when countries engage in preferential trade arrangements, generalizes to cooperative environments as well. In fact, this effect is strong enough to ensure that aggregate world welfare increases as a result of preferential liberalization. We find, therefore, that PTAs are helpful in the sense that they induce governments to serve economic efficiency while they pursue their own political ends.

It is worth noting that the tariff complementarity effect is not a purely theoretical concept, but one that is entirely consistent with the available (although still scarce) evidence. Foroutan (1998), for example, shows that members of effectively implemented regional trade agreements are the most active in reducing

protection against third countries. Authors focusing on specific trading blocs have generally reached similar conclusions. See for example Bohara et al. (2003) for the case of Mercosur and Krueger (2000) for an analysis of NAFTA.

We also find that regionalism, in spite of its aggregate positive effects on economic efficiency, has also important distributive consequences. While the formation of a regional bloc tends to enhance welfare in the member countries, by improving their bargaining power in multilateral negotiations vis-à-vis the excluded countries, the bloc tends to reduce welfare in the latter for the same reason.

At a broader level, this raises the possibility that countries left out of PTAs may seek to form their own PTAs to sustain their relative positions in the multilateral arena. Such a process could lead to a situation where economic efficiency is progressively enhanced with relatively small distributive effects. This could help explain the increasing number of regional integration schemes observed since the early 1990s. In future research, it would be interesting to model such dynamic interactions explicitly to explore this reasoning in detail.

The present analysis can be expanded in several other ways as well. We required, for instance, a linear model to obtain our main results. It remains to be seen whether, or under which conditions, they would extend to more general settings. It would also be interesting to incorporate institutional features in the analysis. Bagwell and Staiger (1999a) show that a politically efficient multilateral agreement cannot be achieved under GATT's negotiating rules if PTAs are allowed. Here we take a distinct stand, assuming that politically efficient agreements can always be achieved—but accounting for the constraints imposed by PTAs when they are present—and analyzing the effects of PTAs on *economic* efficiency. A more complete assessment would mix these two approaches, first characterizing the effects of PTAs on the multilateral agreement that is feasible under GATT negotiating rules, then evaluating their implications for global welfare. As indicated above, political (in)efficiency does not imply economic (in)efficiency, so PTAs may generate a politically inefficient but economically superior equilibrium, even if multilateral negotiations abide by GATT's negotiating rules. We leave this extension for future research.

## Appendix

**Proof of Lemma 2.** We begin by calculating the marginal effects of  $\Upsilon$  and  $\Delta$  on Home's equilibrium domestic price. First, using the definition of  $\Delta$  and  $\Upsilon$  to obtain  $\tau_j = (\Upsilon + \Delta)/2$  and  $\tau_i = (\Upsilon - \Delta)/2$ ,  $i, j = 2, 3$ , we rewrite expression 1 as

$$M(\hat{p}) = E_i \left( \hat{p} - \frac{\Upsilon - \Delta}{2} \right) + E_j \left( \hat{p} - \frac{\Upsilon + \Delta}{2} \right). \quad (14)$$

Totally differentiating equation 14 and setting  $d\Delta = 0$ , we obtain

$$-(b+c) \frac{\partial \hat{p}}{\partial \Upsilon} d\Upsilon = 2(b+d) \left( \frac{\partial \hat{p}}{\partial \Upsilon} - \frac{1}{2} \right) d\Upsilon \iff \frac{\partial \hat{p}}{\partial \Upsilon} = \frac{b+d}{3b+c+2d} = \rho \in \left( \frac{1}{3}, \frac{1}{2} \right).$$

Similarly, totally differentiating equation 14 and setting  $d\Upsilon = 0$ , we find

$$-(b+c)\frac{\partial \hat{p}}{\partial \Delta}d\Delta = (b+d)\frac{\partial \hat{p}}{\partial \Delta}d\Delta \iff \frac{\partial \hat{p}}{\partial \Delta} = 0.$$

Thus, everything else constant, Home's domestic price increases when aggregate protection rises but is unaffected by the composition of the latter.

Now, the effect of a marginal increase in  $\Upsilon$  on world welfare is given by

$$\begin{aligned} \frac{d\Omega}{d\Upsilon} &= [-D(\hat{p}) + S_1(\hat{p})]\rho + (\tau_i + \tau_j)(b+d)\left(\rho - \frac{1}{2}\right) + \frac{M(\hat{p})}{2} \\ &\quad + [-D(\hat{p} - \tau_i) + S_i(\hat{p})]\left(\rho - \frac{1}{2}\right) + [-D(\hat{p} - \tau_j) + S_j(\hat{p})]\left(\rho - \frac{1}{2}\right). \end{aligned}$$

Using the market-clearing condition 1 to rewrite this expression, and recalling that  $\rho < 1/2$ , we then obtain

$$\frac{d\Omega}{d\Upsilon} = (\tau_i + \tau_j)(b+d)\left(\rho - \frac{1}{2}\right) = \Upsilon(b+d)\left(\rho - \frac{1}{2}\right) \leq 0,$$

which holds with strictly inequality if  $\Upsilon > 0$ .

Using  $\partial \hat{p} / \partial \Delta = 0$ , the effect of a marginal increase in  $\Delta$  on world welfare can be similarly calculated:

$$\begin{aligned} \frac{d\Omega}{d\Delta} &= \frac{1}{2}[(\tau_i - \tau_j)(b+d) - E_i(\hat{p} - \tau_i) + E_j(\hat{p} - \tau_j)] \\ &\quad + \frac{1}{2}[-D(\hat{p} - \tau_i) + S_i(\hat{p})] + \frac{1}{2}[D(\hat{p} - \tau_j) - S_j(\hat{p})], \end{aligned}$$

which simplifies to

$$\frac{d\Omega}{d\Delta} = \frac{1}{2}(\tau_i - \tau_j)(b+d) = -\frac{\Delta(b+d)}{2} \leq 0,$$

which holds with strictly inequality if  $\Delta > 0$ . ■

**Proof of Proposition 1.** *i.* It follows from the proof of Lemma 2 that, for a given level of global welfare,

$$\left. \frac{d\Upsilon}{d\Delta} \right|_{\Omega=\bar{\Omega}} = -\frac{d\Omega/d\Delta}{d\Omega/d\Upsilon} = -\frac{\Delta}{(1-2\rho)\Upsilon}.$$

Without discrimination ( $\Delta = 0$ ), the value of this expression is nil, implying that a small increase in  $\Delta$  would require no accompanying decrease in  $\Upsilon$  to keep world welfare constant. A small decrease in one tariff, which increases  $\Delta$  while at the same time decreasing  $\Upsilon$ , must therefore raise  $\Omega$ .

*ii.* Rewrite  $\Omega(\tau, \tau)$  as

$$\Omega(\tau, \tau) = \Omega(0, \tau) + \int_0^\tau \frac{\partial \Omega(\tau_i, \tau)}{\partial \tau_i} d\tau_i.$$

Thus,  $\Omega(\tau, \tau) > \Omega(0, \tau)$  if and only if  $\int_0^\tau \frac{\partial \Omega(\tau_i, \tau)}{\partial \tau_i} d\tau_i > 0$ . Using equation 7—and noting that  $\partial \Omega(\tau_i, \tau) / \partial \tau_i = \partial \sum_j G_j(\tau_i, \tau) / \partial \tau_i$  when  $\gamma_m = \gamma_e = 1$ —we obtain

$$\begin{aligned} \int_0^\tau \frac{\partial \Omega(\tau_i, \tau)}{\partial \tau_i} d\tau_i &= \int_0^\tau [\tau_i M'(\hat{p}) \rho_i - (\tau_i - \tau) E'_j(\hat{p} - \tau) \rho_i] d\tau_i \\ &= \rho \int_0^\tau [\tau_i(-b - c) - (\tau_i - \tau)(b + d)] d\tau_i \\ &= \frac{1}{2}(d - c)\rho\tau^2 > 0. \end{aligned}$$

Hence, starting from a non-discriminatory situation, the elimination of one tariff lowers aggregate world welfare. ■

**Proof of Condition 1.** Under MFN, the tariff is the same regardless of the import source. In such a case, the FONC of the politically efficient tariff corresponds to

$$[(\gamma_m - 1)S_1(\hat{p}) - (b + c)\tau]\rho_m - (\gamma_e - 1) \sum_{j=2,3} S_j(\hat{p} - \tau)(1 - \rho_m) = 0,$$

where  $\rho_m \equiv \frac{d\hat{p}(\tau, \tau)}{d\tau} = 2\rho$  denotes the marginal effect of the tariff on Home's equilibrium price. Rewriting the expression above in the linear case, we obtain

$$[(\gamma_m - 1)c\rho - (\gamma_e - 1)(1 - 2\rho)d]\hat{p} + [(\gamma_e - 1)(1 - 2\rho)d - (b + c)\rho]\tau = 0.$$

It is easy to check that  $\hat{p} = 3A/(3b + c + 2d) + 2\rho\tau$ . Substituting this expression for  $\hat{p}$  in the equality above and reordering it, we find

$$\begin{aligned} 3A[(\gamma_m - 1)c\rho - (\gamma_e - 1)(1 - 2\rho)d] / (3b + c + 2d) \\ + [(\gamma_e - 1)(1 - 2\rho)^2 d - (b + c)\rho + 2c\rho^2(\gamma_m - 1)] \tau = 0. \end{aligned} \quad (15)$$

The coefficient of  $\tau$  must be negative to satisfy the second-order necessary condition and ensure that the politically efficient tariff has an interior solution:

$$2c\rho^2(\gamma_m - 1) + d(1 - 2\rho)^2(\gamma_e - 1) < (b + c)\rho. \quad (16)$$

Provided that the SONC 16 is satisfied, the politically efficient tariff is then strictly positive iff the coefficient of  $3A$  in equation 15 is positive. It is straightforward to see that this condition amounts to having  $(\gamma_e - 1) < \lambda(\gamma_m - 1)$ , where  $\lambda \equiv \frac{c\rho}{(1 - 2\rho)d} = \frac{(b + d)c}{(b + c)d} < 1$ , since  $c < d$  by construction. ■

**Proof of Proposition 5.** *i.* The effect of  $\gamma_m$  on  $\tau_3^{pe}$  can be obtained from the FONC that characterizes  $\tau_3^{pe}$ , equation 8. Implicit differentiation of that expression gives us

$$\frac{d\tau_3^{pe}(\tau_2, \gamma_m)}{d\gamma_m} = \frac{S_1(\hat{p})\rho}{k} > 0.$$

Using the first-order condition for  $\tau_2^{pe}$  and proceeding analogously, we find that  $d\tau_2^{pe}(\tau_3, \gamma_m)/d\gamma_m > 0$  as well.

ii. The tariff complementarity effect is increasing in  $\gamma_m$  iff  $\frac{d^2 \tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2 d\gamma_m} > 0$ .  
 From equations 9 and 10, we have that

$$\begin{aligned} \frac{d^2 \tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2 d\gamma_m} &= \frac{c\rho^2}{k^2} \{k + [(\gamma_m - 1)c\rho - 2d(\gamma_e - 1)(1 - \rho) + (b + d)]\rho\} \\ &= \frac{c\rho^2}{k} \left(1 + \frac{d\tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2}\right) > 0. \end{aligned}$$

iii. To prove the last claim in the proposition, notice that a greater  $\gamma_m$  enhances the positive effect of a PTA on aggregate economic efficiency iff, for any  $\gamma_m'' > \gamma_m'$ ,

$$\begin{aligned} \Omega(0, \tau_3^{pe}(0, \gamma_m'')) - \Omega(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}(\gamma_m''), \gamma_m'')) \\ > \Omega(0, \tau_3^{pe}(0, \gamma_m')) - \Omega(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}(\gamma_m'), \gamma_m')), \end{aligned}$$

or equivalently iff

$$\begin{aligned} \int_{\tau_2^{pe}(\gamma_m')}^{\tau_2^{pe}(\gamma_m'')} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m''))}{d\tau_2} d\tau_2 + \int_0^{\tau_2^{pe}(\gamma_m')} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m''))}{d\tau_2} d\tau_2 \\ < \int_0^{\tau_2^{pe}(\gamma_m')} \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m'))}{d\tau_2} d\tau_2. \end{aligned}$$

We know from the proof of Proposition 3 that  $d\Omega(\tau_2, \tau_3^{pe}(\tau_2))/d\tau_2 < 0$  regardless of  $\gamma_m$ . Since  $\tau_2^{pe}(\gamma_m'') > \tau_2^{pe}(\gamma_m')$  from item *i* of this proposition, the first term of the expression above is negative. Hence, to prove that the inequality above holds, it suffices to show that  $\frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m''))}{d\tau_2} < \frac{d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m'))}{d\tau_2}$  if  $\gamma_m'' > \gamma_m'$ . Or equivalently, that  $d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m))/d\tau_2$  is decreasing in  $\gamma_m$ . From equation 11, we have that

$$\begin{aligned} \frac{d^2 \Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m))}{d\tau_2 d\gamma_m} &= \rho \frac{d\tau_3^{pe}(\tau_2, \gamma_m)}{d\gamma_m} \left[ b + d - \frac{d\tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2} (2b + c + d) \right] \\ &\quad - [(b + c)\tau_3^{pe}(\tau_2, \gamma_m) + (b + d)(\tau_3^{pe}(\tau_2, \gamma_m) - \tau_2)] \rho \frac{d^2 \tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2 d\gamma_m}. \end{aligned}$$

In the right-hand side of this expression, the second term is negative because we consider only situations where  $\tau_2$  is reduced from the politically efficient level (so  $\tau_2 \leq \tau_2^{pe} = \tau_3^{pe}$ ) and because of item *ii* of this proposition; the first term is negative because, from Proposition 2,

$$\frac{d\tau_3^{pe}(\tau_2, \gamma_m)}{d\tau_2} > \frac{b + d}{2b + c + d} = \frac{\rho}{1 - \rho}.$$

Hence,  $d\Omega(\tau_2, \tau_3^{pe}(\tau_2, \gamma_m))/d\tau_2$  is decreasing in  $\gamma_m$ . ■

**Proof of Lemma 3.** The value  $G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$  can be rewritten as  $G_3(0, \tau_3^{pe}(0)) + \int_0^{\tau_2^{pe}} \frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2$ . Hence, the PTA benefits the government of the outside country when transfers are not available if and only if

$\int_0^{\tau_2^{pe}} \frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2 < 0$ . This inequality is satisfied, in particular, if for all  $\tau_2 \geq 0$ ,  $dG_3(\tau_2, \tau_3^{pe}(\tau_2))/d\tau_2 < 0$ . We show that this condition holds.

Dropping the arguments of  $E_3$  and  $S_3$  for brevity, rewrite  $\frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2}$  as

$$\begin{aligned} \frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} &= \frac{\partial G_3(\tau_2, \tau_3^{pe}(\tau_2))}{\partial \tau_2} + \frac{\partial G_3(\tau_2, \tau_3^{pe}(\tau_2))}{\partial \tau_3} \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \\ &= [E_3 + (\gamma_e - 1)S_3] \rho - [E_3 + (\gamma_e - 1)S_3] (1 - \rho) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \\ &= [E_3 + (\gamma_e - 1)S_3] \left[ \rho - (1 - \rho) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right]. \end{aligned}$$

Thus,  $dG_3(\tau_2, \tau_3^{pe}(\tau_2))/d\tau_2 < 0$  for all  $\tau_2 > 0$  iff  $d\tau_3^{pe}(\tau_2)/d\tau_2 > \rho/(1 - \rho)$ , which is true by Proposition 2.

Note now that, by definition, the politically efficient tariffs maximize governments' joint payoff,  $G_1 + G_2 + G_3$ . Thus, this sum must fall under the constraint imposed by the PTA:  $\sum_{i=1,2,3} G_i(0, \tau_3^{pe}(0)) < \sum_{i=1,2,3} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$ .

But since  $G_3(0, \tau_3^{pe}(0)) > G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe}))$ , it follows that  $\sum_{i=1,2} G_i(0, \tau_3^{pe}(0)) <$

$$\sum_{i=1,2} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})). \quad \blacksquare$$

**Proof of Proposition 6.** In the outside country, the change in welfare due to the PTA can be represented as  $[W_3(0, \tau_3^{pe}(0)) + T_3^R] - [W_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3]$ . We will show that this expression cannot be greater than  $[G_3(0, \tau_3^{pe}(0)) + T_3^R] - [G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3]$ , and that the latter must be negative. That is, we will show that

$$\begin{aligned} [W_3(0, \tau_3^{pe}(0)) + T_3^R] - [W_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3] \\ \leq [G_3(0, \tau_3^{pe}(0)) + T_3^R] - [G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3] < 0. \end{aligned} \quad (17)$$

We obtain the second inequality in expression 17 by adding  $[G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) - G_3(0, \tau_3^{pe}(0))]$  to the two sides of expression 13:

$$\begin{aligned} [G_3(0, \tau_3^{pe}(0)) + T_3^R] - [G_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3] \\ \leq \sum_{i=1,2,3} G_i(0, \tau_3^{pe}(0)) - \sum_{i=1,2,3} G_i(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})). \end{aligned}$$

From the definition of the politically efficient equilibrium, the right-hand side of this expression must be negative.

The first inequality in expression 17, in turn, can be rewritten as

$$\int_0^{\tau_2^{pe}} \frac{dW_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2 \geq \int_0^{\tau_2^{pe}} \frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} d\tau_2.$$



This inequality is satisfied, in particular, if  $\frac{dW_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2} \geq \frac{dG_3(\tau_2, \tau_3^{pe}(\tau_2))}{d\tau_2}$  for all  $\tau_2 \geq 0$ . Proceeding as in the proof of Lemma 3, we can rewrite this inequality as

$$\begin{aligned} E_3 \left[ \rho - (1 - \rho) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right] &\geq [E_3 + (\gamma_e - 1)S_3] \left[ \rho - (1 - \rho) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right] \\ &\iff (\gamma_e - 1)S_3 \left[ \rho - (1 - \rho) \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \right] \leq 0 \\ &\iff \frac{d\tau_3^{pe}(\tau_2)}{d\tau_2} \geq \frac{\rho}{1 - \rho}. \end{aligned}$$

Proposition 2 ensures that this inequality holds. Therefore,  $[W_3(0, \tau_3^{pe}(0)) + T_3^R] < [W_3(\tau_2^{pe}, \tau_3^{pe}(\tau_2^{pe})) + T_3]$  and the PTA reduces welfare in the outside country. But since world welfare increases with the PTA (Proposition 3), this result implies that aggregate welfare in the PTA countries must increase as well. ■

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