Strategic Trade Policy and the Threat of Regionalism

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Abstract

We examine the formation of trade agreements when markets are characterized by imperfect competition and governments can alter the strategic interaction between oligopolistic ...rms through the use of import tari¤s and export subsidies. Using a simple three-country model of intra-industry trade, we show that whether preferential trade agreements are stepping stones or stumbling blocs towards the attainment of multilateral cooperation depends on the degree of product di¤erentiation and industry concentration. However, when import tari¤s are the only available policy instrument, global free trade is always sustainable. Our analysis provides a rationale for the recent attempts to strengthen international rules against the use of export subsidies. It also suggests that focusing on one dimension of strategic interaction only might result in drawing incorrect conclusions about the outcome of the trade negotiations.

KEYWORDS: Imperfect Competition, Trade Negotiations.

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1 Introduction

Despite the successful conclusion of the Uruguay Round, there are still some concerns about the erosion of the rules-based multilateral trading system (Whalley and Hamilton, 1996). On the one hand, there is a fear that the proliferation of preferential trade agreements (PTAs) may be leading to the fragmentation of the world economy (see Sampson, 1996).[1] The risk is that "countries that join trading blocs will be more protectionist towards countries outside the blocs than they were before, so that the world as a whole will be hurt more than helped by moves that at ...rst seem to be liberalizing in intent" (Krugman, 1991).

On the other hand, there is a concern that tari¤ barriers might simply be replaced with the use of less transparent trade measures. There is evidence that "protectionism has at long last fallen out of fashion. But export subsidies of all shapes and sizes seem somehow to have become tolerable stands-in. (...) They range from simple ad valorem payments to companies based on the size of their export sales, to complex systems of tax credits, loans, insurance policies and price supports" (The Economist, December 16, 2000).[2] The observed subsidization of exports cannot be rationalized under the hypothesis that product markets are perfectly competitive.[3] The literature on strategic trade policy, on the other hand, has shown that imperfect competition can

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[1] According to Fratzsher (1996), 94 of world trade is conducted within or between the European Union (EU), the North American Free Trade Agreement (NAFTA) and the Association for South East Asian Nations (ASEAN). In the period 1948-1994, GATT contracting parties noti...ed 118 preferential trade agreements relating to trade in goods, of which 38 in the ...ve years ending in 1994. Between 1995 and 1999, 80 additional PTAs covering trade in goods and services were noti...ed to the WTO.

[2] The subsidization of ...rms engaged in international rivalry is a common practice in most industrialized countries. Since direct payments by the government to exporters are prohibited by GATT/WTO rules, countries often use indirect forms of support. For example, according to the European Union, the United States o¤ers export subsidies in the form of tax breaks to a list of nearly ...fty products—including foods, sugars, cereals, oils, textiles, books, glass, ceramics, precious metals, clothes, footwear, toys, aircraft and spacecraft. For this reason, the European Union has recently asked the World Trade Organization permission to impose up to $4 billion of sanctions on the United States.

[3] Under perfect competition, export subsidies do not appear to make much sense, since they improve the terms of trade of the importing country, thus bene...ting foreign consumers (see Panagariya, 2000).

create "pro...t shifting motives" for the use of both import tari¤s and export subsidies.[4]

This paper addresses the two above concerns, by examining whether PTAs are stepping stones or stumbling blocs towards the attainment of multilateral trade liberalization, when product markets are imperfectly competitive and governments can alter the strategic interaction between oligopolistic ...rms through the use of both import tari¤s and export subsidies.

We describe international trade negotiations as a three-stage process. In the ...rst stage, national governments decide whether to form trade agreements to cooperatively select import tari¤s, export subsidies, or both policy instruments.[5] In the second stage, tari¤s and subsidies are selected—cooperatively among countries participating in an agreement and non-cooperatively between countries belonging to separate agreements. In the last stage, ...rms compete in quantities. To determine the outcome of the trade negotiations, we employ the concept of Stable Agreement Structure developed by Conconi and Perroni (2000).

Focusing of the case of three ex-ante symmetric countries, we ...nd that whether PTAs are stepping stones or stumbling blocs towards multilateral trade cooperation will depend on the degree of industry concentration and on the extent of product di¤erentiation. We also show that an international ban on the use of export subsidies would make multilateral trade cooperation sustainable when it would not be otherwise. Thus our analysis provides a rationale for recent strengthening of GATT/WTO rules

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[4] When domestic and foreign ...rms compete in the domestic market, Brander and Spencer (1984a,b) have shown that a tari¤ can be used to shift rents from foreign ...rms to the domestic ...rms and treasury; when domestic and foreign ...rms compete in a third country, Brander and Spencer (1985) have demonstrated that export subsidies can increase welfare by shifting pro...ts from foreign to domestic ...rms. The pro...t-capture motive of trade intervention is most clearly seen when domestic and foreign ...rms are competing in a third country, since the home consumer surplus is not at issue. See Brander (1995) for an extensive review of the literature on strategic trade policy.

[5] The European Union is an example of a PTA in which member countries coordinate the use of both tari¤s and subsidies: national governments cooperatively select a common external tari¤ and delegate to the Commission the task of ensuring that all subsidies granted within the EU are compatible with the single market objectives (see Cini and McGowan, 1998).

against export subsidies (see Laird, 1999).[6]

Most studies of endogenous trade bloc formation assume perfectly competitive markets.[7] An exception is Yi (1996), who employs a multi-country extension of Brander and Spencer (1984a)'s tariff model to describe the process of trade bloc formation under imperfect competition.[8] Focusing on tariff-only negotiations, he concludes that, in the case of three symmetric countries, global free trade is always sustainable.[9] Our analysis shows that Yi's optimistic conclusion might be reversed when one strategic dimension (export subsidies) is added to the trade negotiations. This suggests that modelling trade bloc formation formation as a uni-dimensional process can be misleading and might result in drawing incorrect conclusions about the sustainability of multilateral

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[6] An alternative rationale is suggested by Bagwell and Staiger (1994). In their model, export subsidies are used to coordinate the entry decision of firms. They show that, when subsidy coordination does more to prevent entry than to promote entry, the world as a whole can be better off when export subsidies are banned.

[7] For example, Kennan and Riezman (1990) and Kose and Riezman (1999) construct a pure exchange general equilibrium model with three countries and three goods, in which trade patterns are determined by comparative advantage considerations. Using simulation techniques to compare optimal tariffs and welfare gains in alternative agreement structures, they show that for certain endowment distributions CUs can pose a threat to the multilateral trading system, since, due to the improvement in their terms of trade, member countries can obtain larger welfare gains than at the free trade equilibrium.

[8] Other studies look at the effects of exogenous trade bloc formation under imperfect competition, without considering countries' agreement choices. For example, Sinclair and Vines (1994) have extended Brander and Spencer (1984a)'s tariff model to consider the impact of the creation of CUs and free trade areas (FTAs) on the Nash equilibrium tariffs. In an infinitely repeated version of Brander and Spencer (1985)'s export subsidy game, Collie (1993) has shown that free trade can be sustained by the threat of retaliation with the Nash equilibrium export subsidies, provided that countries are similar and the discount factor is sufficiently high. Collie (1997) has employed a multi-country version of this model to study the effects of trade bloc enlargement.

[9] More generally, Yi finds that CUs are stepping stones towards global free trade if membership of a trade agreement is open to all players, but they might be stumbling blocs towards free trade if the formation of a trade bloc requires the agreement of all potential members and the number of negotiating countries exceeds a critical value.

cooperation. Various studies have pointed out that international tari¤ negotiations might be a¤ected by the existence of alternative policy instruments.[10] However, none of these studies has examined the formation of trade blocs and the issue of the sustainability of multilateral trade cooperation.

The paper is structured as follows. In Section 2, we present a simple three-country model of intra-industry trade. In Section 3, we look at the welfare implications and the stability of alternative trade arrangements. Section 4 considers the e¤ects of the introduction of an international ban on export subsidies. Section 5 concludes.

2   The Model

In this section, we describe a simple model of intra-industry trade between three ex-ante symmetric countries. The speci...cation of production draws on the reciprocal-markets trade model ...rst proposed by Brander (1981) and elaborated by Brander and Krugman (1983) and Dixit (1984).

Each country $i \in I \equiv f1; 2; 3g$ is endowed with an amount $\bar{M}_i$ of a numeraire good, which is transferred across countries to settle the balance of trade. A crucial assumption of the reciprocal-markets model is that markets are segmented, in the sense that ...rms make separate strategic decisions concerning di¤erent markets, rather than selling their output in a uni...ed or integrated world market and relying on arbitrage to distribute it to di¤erent locations.[11] There exists evidence of market segmentation in economic sectors where ...rms have the ability to price discriminate between countries,

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[10]For example, Coopeland (1990) has analyzed the general case of bilateral tari¤ negotiations when there exist non-negotiable domestic policy instruments. Gatsios and Karp (1992) have looked at the imperfect harmonization of trade and industrial policies and note the possibility of welfare reducing preferential trade agreements when members coordinate only the use of tari¤s. A similar result is obtained by Richardson (1994), who shows that the uncoordinated use of domestic taxes/subsidies can render a 'pure' CU unattractive. More recently, Richardson (1999), focusing on the interaction between trade and competition policies, ...nds that the formation of a CU improves members' welfare only if it goes beyond mere trade coordination.

[11]Alternatively, one could assume that oligopolistic ...rms compete in an integrated market (see, for example, Horstmann and Markusen, 1986) or make a two stage decision, setting ...rst their world-wide capacity, and then market speci...c quantities or prices (Venables, 1990).

thus maintaining a dominant position in their domestic markets.[12]

We assume that n identical ...rms are located in each market.[13] All ...rms in a given country produce an identical good at constant marginal cost c, but products are nationally di¤erentiated. Let q_{ik} be sales in country k (destination) by a ...rm located in country i (origin), and $Q_k = \sum q_{ik}$ be total sales in country k.

Preferences of a representative consumer in country k can be described by the following quasilinear utility function

$$u_k(M_k; Y_k; \mu) \; \acute{} \; M_k + v_k \; \acute{} \; M_k + aY_k \; \textrm{¡} \; b \left(\frac{\mu}{2} Y_k^2 + \frac{1 \, \textrm{¡} \, \mu}{2} \sum_i y_{ik}^2 \right); \quad k \; 2 \; I; \quad (1)$$

where M_k is the consumption of the numeraire good, y_{ik} is consumption by country k of a good produced in country i, and $Y_k = \sum_i y_{ik}$ is k's total consumption. The product di¤erentiation parameter μ ranges from 0 (independent goods) to 1 (homogeneous goods). Country k's inverse demand for country i's good is thus given by

$$P_{ik} = a \; \textrm{¡} \; b[(1 \, \textrm{¡} \, \mu)y_{ik} + \mu Y_k]: \quad (2)$$

Market clearing requires that total consumption must be equal to total sales, i.e. $Y_k = n \sum_i q_{ik}$.

We assume that policy makers can alter the strategic interaction between oligopolistic ...rms through the use of import tari¤s and export subsidies. Let t_{ik} denote country k's tari¤s on imports from country i and s_{ki} be its export subsidy (for home ...rms' exports to country i).[14]

Countries may choose to form three types of trade agreements: they can form 'pure' customs unions (CUs), involving the elimination of tari¤s among member countries and

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[12] For example, evidence of market segmentation has been found in the European car market (see Flam and Nordstrom, 1994) and in the market for computer chips (see Baldwin and Krugman, 1988).

[13] We assume that the number of ...rms in each country is ...xed. This can be regarded as a short-run situation or as a situation in which there are legal or technical entry barriers. See Brander and Krugman (1983) and Markusen and Venables (1988) for an analysis of the implications of trade liberalization with free entry.

[14] When product markets are imperfectly competitive, export subsidies and import tari¤s do not 'neutralize' each other, i.e. the optimal response to a foreign export subsidy is not a fully countervailing tari¤ (see Dixit [1984, 1988], and Collie [1991]).

the selection of a common external tari¤ to maximize joint welfare;[15] they can form agreements to cooperatively select export subsidies; or they can form 'impure' CUs, coordinating the use of both policy instruments. We rule out international transfers.[16]

The sequential structure of the model consists of three stages. In the ...rst stage, countries decide whether to form cooperative trade agreements.[17] In the second stage, tari¤s and subsidies are selected—cooperatively among the members of an agreement and non-cooperatively between countries belonging to separate agreements. In the ...nal stage, ...rms compete by choosing quantities in each market. As usual, we start by analyzing the last stage of the game, and solve for the equilibrium for the full game by backward induction. As a solution of the trade negotiation game, we use the concept of Stable Agreement Structure developed by Conconi and Perroni (2000). We refer the reader to the original article for a formal de...nition. Roughly, this is a cooperative and recursive equilibrium concept: to be stable, an agreement structure must be immune from individual as well as joint deviations; and to block, an objection must involve an arrangement that is itself stable.

In the absence of transport costs,[18] the e¤ective cost of supplying the traded good to country k for the ...rm located in country i is $c + t_{ik} \, \textrm{\j} \, s_{ik}$ and its pro...ts are given by

$$\textrm{¼}_{ik} = (P_{ik} + s_{ik} \, \textrm{\j} \, c \, \textrm{\j} \, t_{ik})q_{ik};$$ (3)

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[15] One could also consider the more general case in which the tari¤ agreements are characterized by non-zero tari¤s between members. One institutional justi...cation for the internal zero-tari¤ assumption is the fact that the General Agreement on Tari¤s and Trade (GATT) permits the formation of preferential trade agreements provided that "the duties and other restrictive regulations of commerce are eliminated on substantially all trade between the constituents territories in products originating in such territories" (Article XXIV).

[16] The role of side-payments in international trade negotiations is examined by Kowalczyk and Sjöström (1994).

[17] We assume that countries can credibly commit to trade cooperation. Our analysis thus di¤ers from the strand of the literature which argues against the legitimacy of assuming binding commitments in international trade negotiations (e.g. Bagwell and Staiger, 1997).

[18] Di¤erently from Brander (1981) and Brander and Krugman (1983), we assume that ...rms do not incur any transport costs in supplying foreign markets. However, such costs are assumed to be prohibitive for any third-party arbitragers.

with associated first-order condition[19]

$$\frac{\partial \mu_{ik}}{\partial q_{ik}} = a - c - b(1+n)q_{ik} - bn\mu \sum_{j\neq i} q_{jk} + s_{ik} - t_{ik} = 0. \tag{4}$$

Equation (4) represents the reaction functions (in implicit form) for the firms supplying market k. It shows the best-reply output of a firm, given whatever level of output is produced by the other firms. Notice that the profit function satisfies Hahn (1962)'s condition for stability of a Cournot equilibrium:

$$\frac{d\mu_{ik}}{dq_{jk}} < 0; \quad \forall i \neq j;$$

that is, each firm's marginal revenue in one market declines as the output of any other firm rises.[20] Solving (4) for all $k \geq I$, we obtain domestic and foreign sales in country k at the Cournot equilibrium:

$$q_{kk}(t_{ik}; s_{ik}) = \frac{\circledR(1+n+\mu n) + \mu n(\sum_{i\neq k} t_{ik} - \sum_{i\neq k} s_{ik})}{\pm}; \tag{5}$$

$$q_{ik}(t_{ik}; s_{ik}) = \frac{\circledR(1+n-\mu n) + (1+n+\mu n)(s_{ik} - t_{ik}) + \mu n t_{jk}}{\pm}; \tag{6}$$

where $\circledR = a - c$ is a measure of market size and is assumed to be positive, since otherwise a firm will never produce any output, $\pm = b(1+n-\mu n)(1+n+2\mu n)$, and t_{ik} and s_{ik} are the vectors of tariffs and subsidies for all firms selling in country k. Notice that the quantities produced for market k do not depend on variables in markets other than k. As noted by Brander (1981), this separability property depends crucially on the assumption of constant marginal costs.[21]

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[19] With linear demand, since profits functions are concave, the second-order conditions for profit-maximization are satisfied and there exist a unique Cournot-Nash equilibrium.

[20] Expression (2) also implies that the strategic variables q_{ik} and q_{jk} are strategic substitutes as defined by Bulow et al. (1985).

[21] If marginal costs depended on production levels, market separability would be lost and one could not rule out the kind of strategies considered by Krugman (1984), where an advantage given to a firm in one market spills over into a further advantage in another market.

We rule out corner solutions, assuming that in equilibrium each ...rm produces a strictly positive outcome. Since ...rms sell both at home and abroad, market equilibrium will involve intra-industry trade, even in the case where ...rms located in di¤erent countries sell homogeneous products (cross-hauling).

Equations (5)-(6) imply the following comparative statics e¤ects:

$$\frac{dq_{ik}}{ds_{ik}} = \frac{1 + n ¡ \mu n}{\pm} > 0; \tag{7}$$

$$\frac{dq_{kk}}{ds_{ik}} = \frac{dq_{jk}}{ds_{ik}} = ¡ \frac{\mu n}{\pm} < 0; \tag{8}$$

$$\frac{dq_{ik}}{dt_{ik}} = ¡ \frac{1 + n + \mu n}{\pm} < 0; \tag{9}$$

$$\frac{dq_{kk}}{dt_{ik}} = \frac{dq_{jk}}{dt_{ik}} = \frac{\mu n}{\pm} > 0: \tag{10}$$

Hence, if a country increases its subsidy on exports to a given market, its sales in that market increase, while the sales of all other countries fall; if instead a country increases its tari¤ on imports from a given country, imports from that county fall, while imports from other countries and its own domestic sales increase.

Given the quasilinearity of the utility function, if pro...ts and tax revenues are rebated back uniformly to all consumers, country k's welfare can be written as the sum of domestic consumer surplus, government revenues, and total pro...ts of domestic ...rms in all markets. Using (4), we can express a ...rm's domestic and foreign pro...ts as $\frac{1}{4}_{kk} = bq_{kk}^2(t_{ik}; s_{ik})$ and $\frac{1}{4}_{ki} = bq_{ki}^2(t_{ki}; s_{ki})$, respectively. Welfare can thus be written as

$$
\begin{aligned}
W_k(t_{ik}; s_{ik}; t_{ki}; s_{ki}) \quad &´ \quad v_k(t_{ik}; s_{ik}) ¡ \sum_k nq_{ik}(t_{ik}; s_{ik})p_{ik}(t_{ik}; s_{ik}) + \\
&n@ \sum_{i \ne k} t_{ik}q_{ik}(t_{ik}; s_{ik}) ¡ \sum_k s_{ki}q_{ki}(t_{ki}; s_{ki}) A + \\
&n@ bq_{kk}^2(t_{ik}; s_{ik}) + \sum_{i \ne k} bq_{ki}^2(t_{ki}; s_{ki}) A : \tag{11}
\end{aligned}
$$

In the model described above, there are two sorts of gains from trade: the pro-competitive gains associated with the reduction in market power in the domestic industry, which increase with the degree of industry concentration (i.e. decrease with n);

and the gains from the increase in the variety of goods available to consumers, which increase with the degree of product di¤erentiation (i.e. increase with μ).[22]

3 International Negotiations on Import Tari¤s and Export Subsidies

In this section, we examine the formation of trade agreements when both policy instruments (import tari¤s and export subsidies) are at governments' disposal. In the next section we will examine the impact of introducing an international ban on the use of export subsidies.

With three countries and two strategy dimensions, we need to consider twenty-...ve possible agreement structures, which, given the symmetry assumption, can be restricted to the following ten:

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[22]Notice that, due to the quasilinearity of the utility function and the assumption of market segmentation, there are no terms of trade e¤ects. As remarked by Yi (1996), terms of trade e¤ects are placed solely on the numeraire good.

1. Joint Global Agreement (JGA):
   $\{\{t_1, t_2, t_3\}, \{s_1, s_2, s_3\}\}$;

2. No agreement on either issue:
   $\{\{t_1\}, \{t_2\}, \{t_3\}, \{s_1\}, \{s_2\}, \{s_3\}\}$;

3. Global tariff agreement, no agreement on subsidies:
   $\{\{t_1, t_2, t_3\}, \{s_1\}, \{s_2\}, \{s_3\}\}$;

4. Global agreement on subsidies, no tariff agreement:
   $\{\{t_1\}, \{t_2\}, \{t_3\}, \{s_1, s_2, s_3\}\}$;

5. Partial agreement on subsidies, no tariff agreement:
   $\{\{t_1\}, \{t_2\}, \{t_3\}, \{s_1, s_2\}, \{s_3\}\}$;

6. Partial tariff agreement, no agreement on subsidies :
   $\{\{t_1, t_2\}, \{t_3\}, \{s_1\}, \{s_2\}, \{s_3\}\}$;

7. Partial overlapping agreements on tariffs and subsidies :
   $\{\{t_1, t_2\}, \{t_3\}, \{s_1, s_2\}, \{s_3\}\}$;

8. Partial agreements on tariffs and subsidies:
   $\{\{t_1, t_2\}, \{t_3\}, \{s_1\}, \{s_2, s_3\}\}$;

9. Global tariff agreement and partial agreement on subsidies:
   $\{\{t_1, t_2, t_3\}, \{s_1, s_2\}, \{s_3\}\}$;

10. Global agreement on subsidies and partial tariff agreement:
    $\{\{t_1, t_2\}, \{t_3\}, \{s_1, s_2, s_3\}\}$.

For simplicity, and without loss of generality, in the rest of our analysis we set $\alpha = b = 1$. We first consider the case in which the traded goods are homogeneous ($\mu = 1$), and then examine the case in which firms produce nationally differentiated goods ($\mu < 1$).

3.1   The Case of Homogeneous Goods

Table 1 reports the welfare gains obtained in the di¤erent agreement structures, under alternative assumptions about the number of ...rms located in each market.[23]

As expected, welfare gains increase with the number of ...rms located in each market. This is due to pro-competitive e¤ects associated with the decrease in industry concentration. Notice that, as n increases, the di¤erence between the welfare gains obtained in di¤erent structures falls. The intuition behind this result is that, as markets become more competitive, the pro...t-shifting incentives for the use of import tari¤s and export subsidies tend to disappear.[24]

Table 1 also reveals that agreement structures 1, 4 and 10 and agreement structures 5 and 7 yield the same welfare gains. This implies that tari¤ coordination is irrelevant for countries that are already cooperating over the use of export subsidies.

Comparing the welfare gains obtained under alternative agreement structures, we obtain the following result:

Proposition 1 In the case of homogeneous goods, preferential trade agreements are always stumbling blocs towards the attainment of multilateral trade cooperation.

PROOF: see the Appendix.

The intuition behind Proposition 1 is that, by coordinating the use of export subsidies, two countries are able to shift rents from the ...rms located in the non-member country to their domestic ...rms and treasury,[25] and the pro...t-shifting gains more than o¤set the the costs of forgoing cooperation with the third country.[26]

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[23] The analytical expressions for the equilibrium policies used to derive the results in Table 1 can be found in the Appendix.

[24] The analytical results presented in the Appendix show that, as n ! 1 , optimal tari¤s and subsidies in all agreement structures tend to zero.

[25] This can be seen by comparing the equilibrium policies reported in the Appendix. It is easy to verify that, relative to the JGA, in structures 5, 7 and 9, countries 1 and 2 always choose to subsidize less their exports to country 3 and to subsidize more their exports to each other's markets.

[26] Notice that such costs are smaller in the case of homogeneous products, since there are no product-

Table 1: Agreement Structures and Countries' Welfare (Homogeneous Goods)
($\mu = 1$)

Agreement Structure	Countries' Welfare		
	$n = 1$	$n = 5$	$n = 8$
1. $fft_1; t_2; t_3g; fs_1; s_2; s_3gg$	$W_k = 0:5$	$W_k = 0:5$	$W_k = 0:5$
2. $fft_1g; ft_2g; ft_3g; fs_1g; fs_2g; fs_3gg$	$W_k = 0:4339$	$W_k = 0:4902$	$W_k = 0:4952$
3. $fft_1; t_2; t_3g; fs_1g; fs_2g; fs_3gg$	$W_k = 0:4922$	$W_k = 0:4994$	$W_k = 0:4997$
4. $fft_1g; ft_2g; ft_3g; fs_1; s_2; s_3gg$	$W_k = 0:5$	$W_k = 0:5$	$W_k = 0:5$
5. $fft_1g; ft_2g; ft_3g; fs_1; s_2g; fs_3gg$	$W_{1;2} = 0:51$ $W_3 = 0:4$	$W_{1;2} = 0:5007$ $W_3 = 0:4871$	$W_{1;2} = 0:5003$ $W_3 = 0:4941$
6. $fft_1; t_2g; ft_3g; fs_1g; fs_2g; fs_3gg$	$W_{1;2} = 0:4873$ $W_3 = 0:4229$	$W_{1;2} = 0:4989$ $W_3 = 0:4891$	$W_{1;2} = 0:4995$ $W_3 = 0:4948$
7. $fft_1; t_2g; ft_3g; fs_1; s_2g; fs_3gg$	$W_{1;2} = 0:51$ $W_3 = 0:4$	$W_{1;2} = 0:5007$ $W_3 = 0:4871$	$W_{1;2} = 0:5003$ $W_3 = 0:4941$
8. $fft_1; t_2g; ft_3g; fs_1g; fs_2; s_3gg$	$W_1 = 0:3438$ $W_2 = 0:6667$ $W_3 = 0:4583$	$W_1 = 0:4549$ $W_2 = 0:5732$ $W_3 = 0.4684$	$W_1 = 0:4707$ $W_2 = 0:5510$ $W_3 = 0:4768$
9. $fft_1; t_2; t_3g; fs_1; s_2g; fs_3gg$	$W_{1;2} = 0:5625$ $W_3 = 0:3437$	$W_{1;2} = 0:5208$ $W_3 = 0:4549$	$W_{1;2} = 0:5139$ $W_3 = 0:4707$
10. $fft_1; t_2g; ft_3g; fs_1; s_2; s_3gg$	$W_k = 0:5$	$W_k = 0:5$	$W_k = 0:5$

Since world welfare is always lower when two countries form a PTA than in the case of global trade cooperation, Proposition 1 supports the concern that the world as a whole will be hurt more than helped by the formation of regional trading blocs.

3.2   The Case of Heterogeneous Goods

We now turn our attention to the case of di¤erentiated goods. Tables 2 and 3 report the welfare gains obtained in the nine agreement structures, under di¤erent assumptions about the degree of product di¤erentiation and the degree of industry concentration.[27]

From Tables 2 and 3, we can see that welfare gains increase with the degree of product di¤erentiation (i.e. decrease with μ). The reason behind this result is that, since individuals enjoy variety, an increase in product di¤erentiation implies an increase in consumer surplus.

Comparing the welfare gains obtained under the ten alternative scenarios, we obtain the following result:

Proposition 2 In the case of heterogeneous goods, preferential trade agreement can be stumbling blocs or stepping stones towards the attainment of multilateral trade coop-eration, depending on the degree of product di¤erentiation and industry concentration.

PROOF: the analysis of Table 2 shows that, when the industry is highly concentrated (n = 1) multilateral trade cooperation is the only negotiation outcome. This is because the gains associated with including a third country in the trade agreement (i.e. the increase in product variety and domestic competition) always outweigh the gains from excluding it (i.e. the shift of foreign ...rms' pro...t to the domestic ...rms and treasury). However, from Table 3 we can see that, when the industry is less concentrated (n = 8) and traded goods are rather similar (μ = 8=10), international negotiations can result in the formation of preferential trade agreements. Hence, the more homogeneous the

variety welfare gains from trade cooperation.

[27] The analytical expressions for the equilibrium policies used to derive the results in Tables 2 and 3 can be obtained upon request.

Table 2: Agreement Structures and Countries' Welfare (Heterogeneous Goods)
(n = 1)

Agreement Structure	Countries' Welfare		
	$\mu = 2{=}10$	$\mu = 1{=}2$	$\mu = 8{=}10$
1. $\{\{t_1;t_2;t_3\};\{s_1;s_2;s_3\}\}$	$W_k = 1{:}0088$	$W_k = 0{:}7222$	$W_k = 0{:}5655$
2. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1\};\{s_2\};\{s_3\}\}$	$W_k = 0{:}7551$	$W_k = 0{:}5907$	$W_k = 0{:}4856$
3. $\{\{t_1;t_2;t_3\};\{s_1\};\{s_2\};\{s_3\}\}$	$W_k = 0{:}8907$	$W_k = 0{:}6817$	$W_k = 0{:}5526$
4. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1;s_2;s_3\}\}$	$W_k = 1{:}0088$	$W_k = 0{:}7222$	$W_k = 0{:}5655$
5. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1;s_2\};\{s_3\}\}$	$W_{1;2} = 0{:}9101$ $W_3 = 0{:}0{:}6957$	$W_{1;2} = 0{:}6903$ $W_3 = 0{:}5203$	$W_{1;2} = 0{:}5574$ $W_3 = 0{:}4329$
6. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1\};\{s_2\};\{s_3\}\}$	$W_{1;2} = 0{:}8306$ $W_3 = 0{:}7334$	$W_{1;2} = 0{:}6491$ $W_3 = 0{:}5650$	$W_{1;2} = 0{:}5356$ $W_3 = 0{:}4672$
7. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1;s_2\};\{s_3\}\}$	$W_{1;2} = 0{:}9101$ $W_3 = 0{:}6957$	$W_{1;2} = 0{:}6903$ $W_3 = 0{:}5203$	$W_{1;2} = 0{:}5574$ $W_3 = 0{:}4329$
8. $\{\{t_1\};\{t_2\};\{t_3\};\{s_1\};\{s_2\};\{s_3\}\}$	$W_1 = 0{:}7403$ $W_2 = 1{:}0748$ $W_3 = 0{:}8176$	$W_1 = 0{:}5185$ $W_2 = 0{:}8994$ $W_3 = 0{:}5483$	$W_1 = 0{:}3904$ $W_2 = 0{:}8206$ $W_3 = 0{:}3778$
9. $\{\{t_1;t_2;t_3\};\{s_1\};\{s_2\};\{s_3\}\}$	$W_{1;2} = 0{:}9788$ $W_3 = 0{:}7987$	$W_{1;2} = 0{:}7426$ $W_3 = 0{:}5500$	$W_{1;2} = 0{:}6068$ $W_3 = 0{:}4072$
10. $\{\{t_1;t_2\};\{t_3\};\{s_1;s_2\};\{s_3\}\}$	$W_k = 1{:}0088$	$W_k = 0{:}7222$	$W_k = 0{:}5655$

Table 3: Agreement Structures and Countries' Welfare (Heterogeneous Goods)
(n = 8)

Agreement Structure	Countries' Welfare		
	$\mu = 2=10$	$\mu = 1=2$	$\mu = 8=10$
1. $\text{fft}_1; t_2; t_3 g; \text{fs}_1; s_2; s_3 gg$	$W_k = 1:0683$	$W_k = 0:7485$	$W_k = 0:5760$
2. $\text{fft}_1 g; \text{ft}_2 g; \text{ft}_3 g; \text{fs}_1 g; \text{fs}_2 g; \text{fs}_3 gg$	$W_k = 0:9320$	$W_k = 0:6973$	$W_k = 0:5585$
3. $\text{fft}_1; t_2; t_3 g; \text{fs}_1 g; \text{fs}_2 g; \text{fs}_3 gg$	$W_k = 0:9547$	$W_k = 0:7140$	$W_k = 0:5705$
4. $\text{fft}_1 g; \text{ft}_2 g; \text{ft}_3 g; \text{fs}_1; s_2; s_3 gg$	$W_k = 1:0683$	$W_k = 0:7485$	$W_k = 0:5760$
5. $\text{fft}_1 g; \text{ft}_2 g; \text{ft}_3 g; \text{fs}_1; s_2 g; \text{fs}_3 gg$	$W_{1;2} = 1:0242$ $W_3 = 0:8606$	$W_{1;2} = 0:7440$ $W_3 = 0:6320$	$W_{1;2} = 0:5766$ $W_3 = 0:5291$
6. $\text{fft}_1; t_2 g; \text{ft}_3 g; \text{fs}_1 g; \text{fs}_2 g; \text{fs}_3 gg$	$W_{1;2} = 0:9531$ $W_3 = 0:8926$	$W_{1;2} = 0:7148$ $W_3 = 0:6639$	$W_{1;2} = 0:5694$ $W_3 = 0:5449$
7. $\text{fft}_1; t_2 g; \text{ft}_3 g; \text{fs}_1; s_2 g; \text{fs}_3 gg$	$W_{1;2} = 1:0242$ $W_3 = 0:8606$	$W_{1;2} = 0:7440$ $W_3 = 0:6320$	$W_{1;2} = 0:5766$ $W_3 = 0:5291$
8. $\text{fft}_1; t_2 g; \text{ft}_3 g; \text{fs}_1 g; \text{fs}_2; s_3 gg$	$W_1 = 0:8763$ $W_2 = 1:0867$ $W_3 = 0:9557$	$W_1 = 0:6377$ $W_2 = 0:8060$ $W_3 = 0:6803$	$W_1 = 0:5228$ $W_2 = 0:6262$ $W_3 = 0:5383$
9. $\text{fft}_1; t_2; t_3 g; \text{fs}_1; s_2 g; \text{fs}_3 gg$	$W_{1;2} = 1:0356$ $W_3 = 0:8793$	$W_{1;2} = 0:7542$ $W_3 = 0:6401$	$W_{1;2} = 0:5867$ $W_3 = 0:5278$
10. $\text{fft}_1; t_2 g; \text{ft}_3 g; \text{fs}_1; s_2; s_3 gg$	$W_k = 1:0683$	$W_k = 0:7485$	$W_k = 0:5760$

traded goods and the less concentrated the industry, the higher the risk that regional agreements may lead to the fragmentation of the world economy. Q.E.D.

The results obtained in our analysis are in contrast with the more optimistic conclusions obtained by Yi (1996) who, assuming that import tari¤s are the only available policy instrument, ...nds that free trade is the only stable outcome of the tari¤ negotiations between three ex-ante symmetric countries.[28]

4   Tari¤-only International Negotiations

Export subsidies are prohibited by GATT/WTO rules.[29] However, governments are often able to use indirect forms of export support. These include: more favourable credit conditions (the di¤erence between these and the normal conditions applied to producers for the home market is paid by the government); insurance of certain risks (for example, that the foreign imported defaults) paid by the government; and promotional activities (such as trade fairs, advertising, etc.) organized by public agencies. For this reason, the WTO has recently attempted to strengthen the rules against the use of export subsidies (see Laird, 1999).[30]

[28] Yi (1996) employs a multi-country extension of Brander and Spencer (1984a)'s tari¤ game and focuses on the case in which only one ...rm is located in each country (n = 1). He computes the critical number of countries such that free trade is a stable outcome under both the open regionalism and unanimous regionalism rules. This is an increasing function of the degree of product di¤erentiation. For example, for µ = 0:1, free trade is a stable outcome if there are less than 15 countries, while for µ = 1, the critical value is 4.

[29] In the original GATT agreement in 1947 there was very little discipline on subsidies. The ...rst substantial obligations regarding the use of export subsides were introduced in 1955 (see Article XVI, paragraphs 2-5). A Subsidies Code was adopted at the Tokyo Round and revised at the Uruguay Round by the "Agreement on Subsidies and Countervailing Measures". The latter distinguishes between prohibited, actionable and nonactionable subsidies. See Jackson (1998) for a discussion of the evolution of the rules on subsidies and countervailing duties.

[30] A panel adopted by the WTO Dispute Settlement Body (DSB) in February 2000, requires, for the ...rst time, a company to repay in full an illegal member subsidy from a member government. This case involves a dispute brought against Australia by the US over A$30 million in export subsidies to a producer of automotive leather. Two other recent cases involve export subsidies worth billions of

In this section, we examine how the introduction of an effective ban on export subsidies would affect the outcome of the trade negotiations between three ex-ante symmetric countries. When import tariffs are the only available policy instrument, there are only five possible agreement structures, which, given the symmetry assumption, can be restricted to the following three:

1. Global Free Trade:
   $\{\{t_1; t_2; t_3\}\}$;

2. Nash Equilibrium:
   $\{\{t_1\}; \{t_2\}; \{t_3\}\}$;

3. Partial tariff agreement:
   $\{\{t_1; t_2\}; \{t_3\}\}$.

Comparing the welfare gains obtained in the three alternative agreement structures, we obtain the following result:

Proposition 3 When governments are banned from using export subsidies, global free trade is the only stable negotiation outcome.

PROOF: see the Appendix.

The reason behind this result is that the gains associated with further trade liberalization (i.e. the increase in domestic competition, product variety and export profits) always outweigh the corresponding welfare costs (i.e. the fall in domestic profits and government revenues).

Proposition 3 can illustrated through the use of Tables 4-6, which report the welfare gains obtained in the tariff-only agreement formation game for the same parameterized examples considered in Tables 1-3 above. The same result emerges also from the analysis of Figures 1 and 2, where we plot the welfare functions corresponding to the three agreement structures for the case of homogeneous goods ($\mu = 1$) and the case in which each country has only one firm ($n = 1$).

$US: one rules against US tax exemptions for exporters; the other rules that Brazil has failed to lift the export subsidies to its jet aircraft industries, as required in a previous panel.

Table 4: Agreement Structures and Countries' Welfare (Homogeneous Goods)
($\mu = 1$)

Agreement Structure	Countries' Welfare		
	n = 1	n = 5	n = 8
1. $\{\{t_1; t_2; t_3\}\}$	$W_k = 0{:}4688$	$W_k = 0{:}4981$	$W_k = 0{:}4992$
2. $\{\{t_1\}; \{t_2\}; \{t_3\}\}$	$W_k = 0{:}42$	$W_k = 0{:}4893$	$W_k = 0{:}4949$
3. $\{\{t_1; t_2\}; \{t_3\}\}$	$W_{1;2} = 0{:}4574$ $W_3 = 0{:}4055$	$W_{1;2} = 0{:}4967$ $W_3 = 0{:}4880$	$W_{1;2} = 0{:}4986$ $W_3 = 0{:}4944$

Table 5: Agreement Structures and Countries' Welfare (Heterogeneous Goods)
(n = 1)

Agreement Structure	Countries' Welfare		
	$\mu = 2{=}10$	$\mu = 1{=}2$	$\mu = 8{=}10$
1. $\{\{t_1; t_2; t_3\}\}$	$W_k = 0{:}8854$	$W_k = 0{:}6667$	$W_k = 0{:}5324$
2. $\{\{t_1\}; \{t_2\}; \{t_3\}\}$	$W_k = 0{:}7517$	$W_k = 0{:}58$	$W_k = 0{:}4710$
3. $\{\{t_1; t_2\}; \{t_3\}\}$	$W_{1;2} = 0{:}8262$ $W_3 = 0{:}7297$	$W_{1;2} = 0{:}6356$ $W_3 = 0{:}5523$	$W_{1;2} = 0{:}5151$ $W_3 = 0{:}4491$

Figure 1: Welfare gains (homogeneous goods)

Figure 2: Welfare gains (n = 1)

Table 6: Agreement Structures and Countries' Welfare (Heterogeneous Goods)

(n = 8)

Agreement Structure	Countries' Welfare		
	$\mu = 2=10$	$\mu = 1=2$	$\mu = 8=10$
1. $fft_1; t_2; t_3gg$	$W_k = 1{:}0642$	$W_k = 0{:}7474$	$W_k = 0{:}5757$
2. $fft_1g; ft_2g; ft_3gg$	$W_k = 1{:}0492$	$W_k = 0{:}7384$	$W_k = 0{:}5677$
3. $fft_1; t_2g; ft_3gg$	$W_{1;2} = 1{:}0581$	$W_{1;2} = 0{:}7449$	$W_{1;2} = 0{:}5743$
	$W_3 = 1{:}0435$	$W_3 = 0{:}7315$	$W_3 = 0{:}5611$

Combining Propositions 1-3, we can thus conclude that, in the case of three ex-ante symmetric countries, the introduction of an e¤ective ban on subsidies would make multilateral trade cooperation sustainable when it would not be otherwise.

Proposition (3) is in line with the results obtained by Yi (1996) for the case of three ex-ante symmetric countries. Notice, however, that his optimistic conclusion about the sustainability of free trade would be misleading if policy makers are also able to use export subsidies.

5   Concluding Remarks

In recent years, concerns have been raised about the erosion of the multilateral trading system due to the proliferation of bilateral and regional trade agreements and the increase in the use on non-tari¤ barriers in general and export subsidies. These two threats to the system are interrelated, since many PTAs "increasingly contain trade-related provisions that deal with measures other than tari¤s" (Sampson, 1996).

To examine whether these concerns are justi...ed, in this paper we have studied the

formation of trade agreements when markets are imperfectly competitive and govern-ments can alter the strategic interaction between oligopolistic ...rms through the use of import tari¤s and export subsidies.

Using a simple three-country model of intra-industry trade, we have shown that whether PTAs pose a threat to the global trading system depends on which policy instruments are at governments' disposal, on the degree of industry concentration, and on the extent of product di¤erentiation. When both import tari¤s and export tari¤s are available and traded goods are homogeneous, PTAs involving the coordinated use of export subsidies are always stumbling blocs towards multilateral trade cooperation. If both policy instruments are available but products are nationally di¤erentiated, multilateral cooperation is sustainable only in those sectors where the degree of product di¤erentiation and industry concentration are large enough, so that the product-variety and pro-competitive gains from global trade cooperation outweigh the pro...t-shifting gains from preferential trade cooperation. When export subsidies are banned and import tari¤s are the only available policy instrument, global free trade is always sustainable.

Our results provide a rationale for the recent attempts to strengthen international rules against the use of export subsidies. More generally, our analysis shows that, when national governments can use di¤erent trade policy instruments, trade bloc formation should be described as a multi-dimensional agreement formation game; focusing on one policy dimension only might result in drawing incorrect conclusions about the outcome of the negotiations.

We conclude by pointing out three directions of further research. First, it would be important to examine how the outcome of the trade negotiations is a¤ected by changes in the number of parties involved. Second, the analysis of this paper should be extended to study the case of asymmetric countries and the bargaining problems that arise among heterogeneous agreements' members. Finally, the literature on strategic trade policy has shown that governments can use a wide range of instruments (import tari¤s, export subsidies, domestic subsidies, voluntary export restraints, R&D subsidies, competition policy, etc.) to shift rents from foreign to domestic ...rms. More work is needed to understand how the availability of such instruments a¤ects the incentives to form trade agreements.

Appendix

Equilibrium Policies (Homogeneous Goods)

In what follows, we report the optimal policies obtained for the case in which n ...rms are located in each country and they sell homogeneous products ($\mu = 1$).

1. $\{\{t_1; t_2; t_3\}; \{s_1; s_2; s_3\}\}$:

$$t_{ik} = 0;$$

$$s_{ik} = \frac{1}{2n};$$

2. $\{\{t_1\}; \{t_2\}; \{t_3\}; \{s_1\}; \{s_2\}; \{s_3\}\}$:

$$t_{ik} = \frac{1 + n}{1 + 7n + 11n^2 + 3n^3};$$

$$s_{ik} = \frac{1 + 3n + 3n^2}{1 + 7n + 11n^2 + 3n^3};$$

3. $\{\{t_1; t_2; t_3\}; \{s_1\}; \{s_2\}; \{s_3\}\}$:

$$t_{ik} = 0;$$

$$s_{ik} = \frac{1 + n}{2(3 + 5n)^2};$$

4. $\{\{t_1\}; \{t_2\}; \{t_3\}; \{s_1; s_2; s_3\}\}$:

$$t_{ik} = \frac{1}{2n};$$

$$s_{ik} = \frac{1}{n};$$

5. $\{\{t_1\}; \{t_2\}; \{t_3\}; \{s_1; s_2\}; \{s_3\}\}$:

$$t_{12} = t_{21} = \frac{1}{2};$$

$$t_{31} = t_{32} = s_{31} = s_{31} = 0;$$

$$t_{13} = t_{23} = \frac{1 + 2n + 3n^2}{1 + 7n + 9n^2 + 3n^2};$$

$$s_{12} = s_{21} = \frac{2}{n};$$

$$s_{13} = s_{23} = \frac{1 \; n}{1 + 7n + 9n^2 + 3n^2}.$$

6. $\{\{t_1\}; \{t_2; t_3\}; \{s_1\}; \{s_2\}; \{s_3\}\}$:

$$t_{12} = t_{21} = 0;$$

$$t_{31} = t_{32} = \frac{1 + 4n + 6n^2}{2 + 14n + 29n^2 + 18n^3};$$

$$t_{13} = t_{23} = \frac{1 + 3n + 3n^2}{1 + 7n + 11n^2 + 3n^3};$$

$$s_{12} = s_{21} = \frac{1 + 4n + 3n^2}{2n + 10n^2 + 9n^3};$$

$$s_{13} = s_{23} = \frac{1 + n}{1 + 7n + 11n^2 + 3n^3};$$

$$s_{31} = s_{31} = \frac{1 + n}{2 + 14n + 29n^2 + 18n^3}.$$

7. $\{\{t_1; t_2\}; \{t_3\}; \{s_1; s_2\}; \{s_3\}\}$:

$$t_{12} = t_{21} = \frac{1}{2};$$

$$t_{31} = t_{32} = s_{31} = s_{31} = 0;$$

$$t_{13} = t_{23} = \frac{1 + 2n + 3n^2}{1 + 7n + 9n^2 + 3n^2};$$

$$s_{12} = s_{21} = \frac{2}{n};$$

$$s_{13} = s_{23} = \frac{1 - n}{1 + 7n + 9n^2 + 3n^2}.$$

8. $\mathrm{fft_1; t_2g; ft_3g; fs_1g; fs_2; s_3gg}$:

$$t_{12} = t_{21} = t_{31} = t_{13} = s_{12} = s_{13} = 0;$$

$$t_{32} = t_{23} = \frac{1}{n};$$

$$s_{23} = s_{32} = \frac{2}{n};$$

$$s_{31} = -\frac{1 + 4n}{2(1 + 3n + 2n^2)};$$

$$s_{21} = \frac{1 + 2n + 2n^2}{2n + 6n^2 + 4n^3}.$$

9. $\mathrm{fft_1; t_2; t_3g; fs_1; s_2g; fs_3gg}$:

$$t_{12} = t_{21} = t_{31} = t_{32} = t_{13} = t_{23} = s_{31} = s_{31} = 0;$$

$$s_{12} = s_{21} = \frac{1}{n};$$

$$s_{13} = s_{23} = \frac{1 - n}{4n(1 + n)}.$$

10. $\mathrm{fft_1; t_2g; ft_3g; fs_1; s_2; s_3gg}$:

$$t_{12} = t_{21} = 0;$$

$$t_{31} = t_{32} = t_{13} = t_{23} = s_{12} = s_{21} = \frac{1}{2n};$$

$$s_{13} = s_{23} = s_{31} = s_{31} = \frac{1}{n}.$$

Proof of Proposition 1

Substituting the optimal policies reported above into equations (5), (6) and (11), we can derive analytical expressions for the welfare gains obtained by the three countries under the alternative agreement structures. Comparing these expressions, it is straightforward to verify that

$W_{1;2}^9 - W_{1;2}^{5;7} > 0,$

$W_{1;2}^{5;7} - W_k^{1;4;10} > 0,$

$W_k^{1;4;10} - W_k^3 > 0,$

$W_k^3 - W_{1;2}^6 > 0,$

$W_{1;2}^6 - W_k^2 > 0,$

$W_k^2 - W_3^6 > 0,$

$W_3^6 - W_3^{5;7} > 0,$

$W_3^{5;7} - W_3^9 > 0.$

Hence the welfare ranking is always $W_{1;2}^9 > W_{1;2}^{5;7} > W_k^{1;4;10} > W_k^3 > W_{1;2}^6 > W_k^2 > W_3^6 > W_3^{5;7} > W_3^9$, independently on the degree of industry concentration.[31] Notice that agreement structures 5 and 7 are welfare improving for countries 1 and 2, relative to all other agreement structures, except structure 9. However, the latter is not stable, since country 3 will always object to it by leaving the tariff agreement. Structures 5 and 7, on the other hand, cannot be blocked by country 3 and are thus the only stable negotiation outcome.   Q.E.D.

Proof of Proposition 3

When import tariffs are the only available policy instrument, the optimal tariffs under the three possible agreement structures are as follows:

1. Global Free Trade: $ff t_1; t_2; t_3 gg;$

$$t_{ik} = 0:$$

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[31] The ranking of agreement structure 8 varies with n. However, structure 8 can never be stable, since country 1 is always worse off than in any the case of no cooperation.

2. Nash Equilibrium: $\{\{t_1\}; \{t_2\}; \{t_3\}\}$;

$$t_{ik} = \frac{1 + 2n - (\mu^2 - 1)n^2}{2 + (5 + \mu)n + (4 + 2\mu - 4\mu^2)n^2 + (1 + \mu - 2\mu^2)n^3}.$$

3. Partial tariff agreement: $\{\{t_1; t_2\}; \{t_3\}\}$.

$$t_{12} = t_{21} = 0;$$

$$t_{31} = t_{32} = \frac{(1 + (1 - \mu)n)(1 + n + 3\mu n)}{2 + (5 + 4\mu)n + 2(2 + 3\mu - \mu^2)n^2 + (1 + 2\mu - \mu^2 - 2\mu^3)n^3};$$

$$t_{13} = t_{23} = \frac{(1 + (1 - \mu)n)(1 + n + \mu n)}{2 + (5 + \mu)n + (4 + 2\mu - 4\mu^2)n^2 + (1 + \mu - 2\mu^2)n^3}.$$

Comparing the welfare functions obtained by plugging the equilibrium tariffs into (5), (6) and (11), we find:

$W_k^1 - W_{1;2}^3 > 0,$

$W_{1;2}^3 - W_k^2 > 0,$

$W_k^2 - W_3^3 > 0.$

Hence, the welfare ranking is always $W_k^1 > W_{1;2}^3 > W_k^2 > W_3^3$, independently on the degree of product differentiation and industry concentration. Since global free trade always yields larger welfare gains than any other tariff arrangement, no country will ever want to deviate from it.   Q.E.D.

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