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Is Bilateralism Consistent with Global Free Trade?

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Abstract

Some studies show that bilateralism is consistent with global free trade under pairwise stability. By using an alternative stability concept we find that this is not always the case. Nonetheless, a system of transfers could help to stabilize this condition.

Key words: bilateralism; global free trade; network equilibrium

JEL classification: F12; F13

1. Introduction

Efficiency and stability are two terms that have been used in many economic areas. One of them is international trade. According to some researchers, global free trade is the efficient relationship among countries, which implies maximum world social welfare (see, for example, Goyal and Joshi, 2006, and Yi, 2000). Is this condition stable? The stability of global free trade has been analyzed under different types of agreement schemes: custom unions and free trade agreements (see, for instance, Furusawa and Konishi, 2007, and Yi, 1996).

Regarding free trade agreements, Furusawa and Konishi (2007), using a network model and assuming symmetrical countries, find that global free trade is stable under bilateralism (i.e., when countries are involved in bilateral agreements) when negotiations include social welfare considerations and when tariffs are determined exogenously (although they partially analyze the case of endogenous tariffs in Remark 2 of their paper). Likewise Goyal and Joshi (2006), using a network model and assuming that governments consider a weighted welfare function as their objective function, find that global free trade is always an equilibrium independent of any bias in favor of either consumers or firms when tariffs are exogenous. This implies that bilateralism can be used as a strategy to reach global free trade. These authors find that "if countries are symmetric, a complete network, i.e., one in which every pair of countries has a free trade agreement (and thus global

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free trade obtains), is consistent with the incentives of individual countries. This result suggests that bilateralism can be seen as a useful building step toward a liberal world trading system" (p. 769). Goyal and Joshi (2006) extend the analysis for the case of endogenous tariffs and find that global free trade is stable when governments are unbiased. However, they explain that this analysis is only partial given its complexity. They explain "Given the complexity of the computations involved, we have been unable to completely characterize the nature of stable networks in this setting. We do have some interesting partial results" (p. 768). Unfortunately this partial analysis does not include unbiased countries when tariffs are determined endogenously.

Furusawa and Konishi (2007) and Goyal and Joshi (2006) use the pairwise stability concept developed by Jackson and Wolinsky (1996). Pairwise stability establishes that an international trade network is stable when no country has an incentive to break an existing international agreement between them, and, if two countries are not involved in an international agreement, then at least one of them does not have an incentive to form one.

Yi (2000), on the other hand, analyses two types of free trade systems using a framework similar to Goyal and Joshi (2006): (1) the open regionalism system in which any country can join an existing free-trade area and (2) the unanimous regionalism system in which joining an existing free-trade area requires the unanimous approval of the existing member countries. In order to obtain the set of stable free-trade areas, Yi (2000) uses a Nash equilibrium concept based on a simultaneous-move open regionalism game to analyze the open regionalism system. For the unanimous regionalism system, he uses a Nash equilibrium concept based on an infinite-horizon sequential game. Using these equilibrium concepts, the author finds that global free trade is not always stable when governments are unbiased, when the number of countries is large enough (i.e., more than 9), and when tariffs are determined endogenously. Because the present paper deals with the issue of global free trade stability in an international network context and because an international network model is in essence an "open regionalism system" under the terminology of Yi (2000), we only consider the Nash equilibrium that this researcher uses under the simultaneous-move open regionalism game.

In this paper we argue that neither pairwise stability nor the Nash equilibrium concept used by Yi (2000) under the open regionalism system is appropriate to study international trade networks. On the one hand, pairwise stability assumes that countries can only break one international trade agreement at a time. However, it is well known that in the real world countries can break unilaterally as many international agreements as they want simultaneously. On the other hand, using a traditional Nash equilibrium concept in a network framework produces many unrealistic equilibriums. This is formally explained by Bloch and Jackson (2006): "It is easy to see that the concept of Nash stability is too weak as a concept for modelling network formation when links are bilateral, as it allows for too many equilibrium networks. For instance, the empty network is always a Nash network, regardless of the payoff structure" (p. 309).

We argue that the most suitable equilibrium concept to be used in international network models is the strongly pairwise stability concept formally studied by Gilles and Sarangi (2005, 2004a, 2004b) and first proposed as an extension by Jackson and Wolinsky (1996) and referred to as pairwise Nash equilibrium by Bloch and Jackson (2006). Strongly pairwise stability has the property that countries are allowed to break multiple links at the same time. Moreover, the set of strongly pairwise stable networks is equal to the intersection of the sets of Nash stable networks and pairwise stable networks (Bloch and Jackson, 2006). This is an interesting and useful property that we use in this paper when considering endogenous tariffs.

In this paper we use and test the strongly pairwise stability concept in the Goyal and Joshi (2006) model. We recognize, however, that the international network model of Furusawa and Konishi (2007) is more general and complex in terms of market structure than that of Goyal and Joshi (2006). Nonetheless, the model of the former does not consider government's political motivations. This is because Furusawa and Konishi (2007) assume that welfare is equal to the utility of the representative consumer, which is constrained by his income (the sum of profits, labor income, and tariff revenue). In fact, these authors recognize in the conclusions that their framework should be reformulated in order to introduce government's political motivations. In contrast, the model of Goyal and Joshi is more general in terms of political incentives given by their weighted welfare function. In fact, Baldwin (1987) proves that maximizing a weighted welfare function is equivalent to maximizing the numbers of votes under the majority rule principle. Likewise, Gardner (1987) shows empirically that a weighted welfare function can also represent competition among pressure groups; Becker (1983) developed related theory. This makes the Goyal and Joshi model richer and more realistic in terms of trade policy biases, which is reflected in their set of possible stable networks, and this is why we use this international network model as a benchmark model to determine the stability of global free trade.

By using strongly pairwise stability in the framework of Goyal and Joshi (2006) we find that global free trade is not always stable. This implies that bilateralism is not necessarily consistent with global free trade. However, a system of transfers financed by consumers could help to stabilize this condition. This result is also interesting because this is a novel example of transfers inside of nodes (or intra-node transfers), which is politically feasible. In fact, it is usually argued that pairwise unstable efficient networks (and therefore strongly pairwise unstable efficient networks) can be stabilized using transfers from different nodes (or inter-node transfers), and this is the focus used by Furusawa and Konishi (2005). However, this strategy is in many cases impossible because of a coordination problem (see Jackson and Wolinsky, 1996, and Jackson, 2004, for discussions). But in the case of international trade networks, the use of domestic redistributive policies (intra-node transfers) does not depend on the simultaneous consent of the signatory countries, but only on the decision of a single government.

The remainder of this paper is structured as follows. Section 2 presents the basic framework of Goyal and Joshi (2006). Section 3 presents the strongly pairwise stability concept formally developed by Gilles and Sarangi (2005, 2004a, 2004b). Section 4 studies whether global free trade is stable under strongly pairwise stability when tariff rates are exogenous. Section 5 presents extensions including asymmetric countries and endogenous tariffs, and Section 6 concludes.

2. The Goyal and Joshi Framework

In the network model each country has only one firm that can sell in the domestic market and potentially in foreign markets. Each country establishes a prohibitive tariff avoiding any trade among them. If two countries decide to sign a free trade agreement, then each offers the other free market access, i.e., each offers a zero tariff. This means that tariff rates are exogenous in this model. This assumption is relaxed in Section 5.

2.1 The Network Model

An international agreement between countries i and j is described by a link, given by a binary variable $g_{ij} \in \{0,1\}$ with $g_{ij} = 1$ if an agreement exists between countries i and j and $g_{ij} = 0$ otherwise. A network $g = \{(g_{ij})_{ij \in N}\}$ is a description of the international agreements that exist among a set $N = \{1, \ldots, N^*\}$ of identical countries, where N^* is the total number of countries. Networks g^c and g^e are the complete network (i.e., $g_{ij} = 1$ for all $i, j \in N$) and the empty network (i.e., $g_{ij} = 0$ for all $i, j \in N$). Let G denote the set of all possible networks, $g + g_{ij}$ denote the network obtained by replacing $g_{ij} = 0$ in network g by $g_{ij} = 1$, and $g - g_{ij}$ denote the network obtained by replacing $g_{ij} = 1$ in network g by $g_{ij} = 0$. Let $N_i(g) = \{ j \in N : g_{ij} = 1\}$ be the set of countries with whom country i has an international trade agreement in network g. Assume that $i \in N_i(g)$ so that $g_{ii} = 1$. The cardinality of $N_i(g)$ is denoted η_i. In this model η_i is also the number of active firms in country i because of the assumption that each country has only one firm (note that the domestic firm in country i is included in η_i). Let $L_i(g) = \{g_{ij} = 1 : j \in N_i(g)\}$ be the set of links existing in country i in network g. Note that $g_{ii} \in L_i(g)$. Finally, let h_i be a link subset such that $h_i \subset L_i(g) - \{g_{ii}\}$ and let μ_i be the cardinality of h_i.

Goyal and Joshi (2006) assume that the objective function of the government of each country $i \in N$ is a weighted welfare function $W_i : G \to \mathbb{R}$. This function is:

$$W_i(g) = a_i CS_i(g) + b_i \pi_i(g) , \tag{1}$$

where $CS_i(g)$ is the consumer surplus in network g, $\pi_i(g)$ is the total profit of the domestic firm in network g, and a_i and b_i (with $0 \le a_i \le 1$ and $0 \le b_i \le 1$) are exogenous weights representing the bias of governments in favor of either consumers surplus or profits.

2.2 Imperfect Competition

Let $P_i = \alpha_i - Q_i$ be the inverse demand of the unique good in country $i \in N$, where P_i is the price of this good in the domestic market in country i, α_i represents the size of this market, and Q_i is the total output demanded in this country. Let $\gamma_i < \alpha_i$ be the marginal cost of the firm in country i. In this paper we assume that all countries are symmetrical (i.e., $\alpha_i = \alpha$ and $\gamma_i = \gamma$ for all $i \in N$). We also assume that firms play Cournot competition in each market where they compete. The equilibrium output of the firm in country i in the domestic market is $Q_i^i(g) = (\alpha - \gamma)/(\eta_i + 1)$ and the total output of equilibrium in this market is $Q_i(g) = (\alpha - \gamma)\eta_i/(\eta_i + 1)$. Likewise, the equilibrium output of the firm in country i that is sold in country k is $Q_k^i(g) = (\alpha - \gamma)/(\eta_k + 1)$.

Consumer surplus in country i (i.e., $CS_i(g)$), profit of the firm in country i in the domestic market (i.e., $\pi_i^i(g)$), and profit of the same firm in country k (i.e., $\pi_k^i(g)$) are given by $Q_i(g)^2/2$, $(P_i - \gamma)Q_i^i(g)$, and $(P_k - \gamma)Q_k^i(g)$. By replacing the equilibrium quantities and the inverse demand into these expressions we obtain:

$$CS_i(g) = (\alpha - \gamma)^2 \eta_i^2 / 2(\eta_i + 1)^2 = (\alpha - \gamma)^2 \widetilde{CS}_i(g)$$
$$\pi_i^i(g) = (\alpha - \gamma)^2 / (\eta_i + 1)^2 = (\alpha - \gamma)^2 \tilde{\pi}_i^i(g)$$
$$\pi_k^i(g) = (\alpha - \gamma)^2 / (\eta_k + 1)^2 = (\alpha - \gamma)^2 \tilde{\pi}_k^i(g).$$

We use the expressions $\widetilde{CS}_i(g)$, $\tilde{\pi}_i^i(g)$, and $\tilde{\pi}_k^i(g)$ in Section 5. Finally, the total profit of the firm in country i in network g is $\pi_i(g) = \sum_{k \in N_i(g)} \pi_k^i(g)$.

From these expressions and by assuming that $\alpha - \gamma = 1$ without loss of generality, the welfare function defined in (1) becomes:

$$W_i(g) = a_i \frac{1}{2} \frac{\eta_i^2}{(\eta_i + 1)^2} + b_i \sum_{k \in N_i(g)} \frac{1}{(\eta_i + 1)^2}. \tag{2}$$

3. Stability

Here we describe several concepts adapted from Gilles and Sarangi (2005, 2004a, 2004b):

(i) The marginal benefit in country i when breaking an international agreement with country j is $D_i(g, g_{ij}) = W_i(g) - W_i(g - g_{ij}) \in \mathbb{R}$.

(ii) The marginal benefit in country i when deleting (simultaneously) $h_i \in L_i(g)$ international agreements is $D_i(g, h_i) = W_i(g) - W_i(g - h_i) \in \mathbb{R}$.

Using these concepts, Gilles and Sarangi (2005, 2004a, 2004b) define:

(a) A network $g \in G$ is *link deletion proof* if for every player $i \in N$ and every neighbor $j \in N_i(g)$ it holds that $D_i(g, g_{ij}) \geq 0$. Let $D \subset G$ be the set of link deletion proof networks.

(b) A network $g \in G$ is *strong link deletion proof* if for every player $i \in N$

and every $h_i \in L_i(g)$ it holds that $D_i(g, h_i) \geq 0$. Let $D_S \subset G$ be the set of strong link deletion proof networks.

(c) A network $g \in G$ is *link addition proof* if $W_i(g + g_{ij}) > W_i(g)$ implies that $W_j(g + g_{ij}) < W_j(g)$ for all $i, j \in N$. Let $A \subset G$ be the set of link addition proof networks.

Gilles and Sarangi (2005, 2004b) use these definitions to establish the following equilibrium concepts:

(d) A network $g \in G$ is *pairwise stable* if g is link deletion proof as well as link addition proof. Let $P = D \cap A \subset G$ be the set of pairwise stable networks.

(e) A network $g \in G$ is *strongly pairwise stable* if g is strong link deletion proof as well as link addition proof. Let $\widetilde{P} = D_S \cap A \subset G$ be the set of strongly pairwise stable networks.

Finally, Gilles and Sarangi (2005, 2004b) provide the following definition that we use in Section 4:

(f) W_i is *link monotonic* if $W_i(g) < W_i(g + g_{ij})$ for all networks $g \in G - \{g^c\}$ or if $W_i(g - g_{ij}) > W_i(g)$ for all networks $g \in G - \{g^e\}$.

Pairwise stability is not appropriated to study international trade networks because in the real world countries can break more than one international agreement at the same time. This implies that any stable international trade network must be strong link deletion proof. Considering this fact, we conclude that strongly pairwise stability is the most suitable stability concept to study international trade networks.

Strongly pairwise stability is also preferred to the traditional Nash equilibrium concept used by Yi (2000) for the open regionalism system. Myerson (1991) was the first researcher to introduce the latter type of equilibrium into a network context; it is derived from a non-cooperative game (similar than that used by Yi, 2000) referred to as “linking game” (see Bloch and Jackson, 2006). As we explain in the introduction, this equilibrium concept is too weak because it allows for unrealistic equilibriums like the empty network, which is independent of the payoff structure of the players.

Finally, strongly pairwise stability has a useful property that we will use later in this paper: let $\widetilde{P}$, P, and NE be the sets of strongly pairwise stable networks, pairwise stable networks, and Nash equilibrium networks. Then $\widetilde{P} = P \cap NE$ (Bloch and Jackson, 2006).

4. Global Free Trade Stability (Exogenous Tariffs)

The main result of Goyal and Joshi (2006) using pairwise stability is as follows:

***Proposition 0*:** Assume that $N^* \geq 3$. Under exogenous tariffs, the complete network (global free trade) is always pairwise stable for any bias of governments, i.e., for any values of a_i and b_i in (2). Under endogenous tariffs, the complete network is pairwise stable for unbiased countries, i.e., when $a_i = b_i \neq 0$.

The intuition for the case of exogenous tariffs is as follows. When welfare is equal to consumer surplus, a country is always better off by adding new international agreements. This is because the number of active firms in the domestic market increases, making this market more competitive and therefore consumer surplus increases. That is, consumer surplus is, in this model, link monotonic. In particular $\partial CS_i(g)/\partial\eta_i = \eta_i/(\eta_i + 1) > 0$ for all $g \in G - \{g^c\}$, which implies that $CS_i(g^c) > CS_i(g^c - h_i)$ for all $\mu_i > 0$.

On the other hand, when welfare is equal to total profit, there are two opposite effects that arise when a country cuts existing links. The competition effect, $CE_i(g - h_i)$, is the gain of profits that the domestic firm obtains in the domestic market when this market becomes less competitive after μ_i links are broken. That is, $CE_i(g - h_i) > 0$ for all $\mu_i > 0$ and for all $g \in G - G(g_i^a)$, where $G(g_i^a)$ is the set of networks g_i^a in which country i is in autarky (e.g., $g^e \in G(g_i^a)$). The expansion effect, $EE_i(g - h_i)$, corresponds to the loss of foreign profits that the domestic firm faces when μ_i links are broken. That is, $EE_i(g - h_i) < 0$ for all $\mu_i > 0$ and all $g \in G - G(g_i^a)$. Thus, if μ_i links are broken, then total profit increases when $CE(g - h_i) > -EE(g - h_i)$, and the opposite holds when $CE(g - h_i) < -EE(g - h_i)$. This implies that the sign of $\partial\pi_i(g)/\partial\eta_i$ is not clear and depends on the relative number of links existing between countries. In the Goyal and Joshi framework it holds that $CE(g^c - g_{ij}) < -EE(g^c - g_{ij})$ for all $i \in N$ when $N^* \geq 3$, for which breaking a link in g^c is not profitable for any active firm in the world. The reason is that in g^c domestic markets are completely integrated for which domestic firms have small market power. It is for this reason that the marginal gain of domestic profits when breaking a single link in g^c is too small to overcome the loss of foreign profits. To see that, note that:

$$\pi_i(g^c) = \pi_i^i(g^c) + \pi_{-i}^i(g^c) = 1/(N^* + 1)^2 + (N^* - 1)/(N^* + 1)^2$$
$$\pi_i(g^c - g_{ij}) = \pi_i^i(g^c - g_{ij}) + \pi_{-i}^i(g^c - g_{ij}) = 1/N^{*2} + (N^* - 2)/(N^* + 1)^2 \,.$$

Simple calculation shows that $\pi_i(g^c) > \pi_i(g^c - g_{ij})$ when $N^* \geq 3$. Thus, because it is verified that $CS_i(g^c) > CS_i(g^c - g_{ij})$ and that $\pi_i(g^c) > \pi_i(g^c - g_{ij})$ for all $i \in N$, Goyal and Joshi (2006) prove that under pairwise stability $W_i(g^c) \geq W_i(g^c - g_{ij})$ for any bias when $N^* \geq 3$.

An interesting property of the framework of Goyal and Joshi (2006) is that the condition $CE(g^c - g_{ij}) < -EE(g^c - g_{ij})$ can be reversed when allowing countries to cut multiple links. That is, it holds that $CE(g^c - h_i) > -EE(g^c - h_i)$ for some values of μ_i because, by breaking this number of links, domestic firms can exercise enough market power to overcome the loss of foreign profits. This implies that global free trade g^c is not always strongly pairwise stable when tariffs are exogenous and when consumers are under-represented in the welfare function. This fact is shown in the following proposition.

***Proposition 1*:** Assume exogenous tariffs and $N^* > 1$. For all $i \in N$ there always exist values of $\eta_i > 0$ (with $\eta_i \lesssim N^*$) such that (i) $0 \leq a_i/b_i < 1$ implies $g^c \notin \tilde{P}$ and (ii) $a_i/b_i \geq 1$ implies $g^c \in \tilde{P}$.

Proof. We first prove (i). We must show that there exist both a positive $\eta_i < N$ and a nonnegative a_i/b_i (with $a_i/b_i < 1$) such that $D_i(g^c, h_i) < 0$. Using (2) we define:

$$W_i(g^c) = a_i \frac{1}{2}\frac{N^{*2}}{(N^*+1)^2} + b_i \frac{N^*}{(N^*+1)^2} \tag{3}$$

$$W_i(g^c - h_i) = a_i \frac{1}{2}\frac{\eta_i^2}{(\eta_i+1)^2} + b_i \left[\frac{1}{(\eta_i+1)^2} + \frac{\eta_i - 1}{(N^*+1)^2}\right]. \tag{4}$$

From these expressions we infer that $D_i(g^c, h_i) < 0$ when:

$$\frac{a_i}{b_i} < \frac{(N^*+1)^2 - (\eta_i+1)^2(N^*+1-\eta_i)}{N^{*2}(\eta_i+1)^2 - \eta_i^2(N^*+1)^2} = \frac{\sigma}{\theta}. \tag{5}$$

Now, because $\theta > 0$ for all $N^* > \eta_i$ and because there is always a positive $\eta_i < N^*$ such that $\sigma > 0$ for all $N^* > 1$, we conclude that there are always values of $\eta_i > 0$ and $a_i/b_i \geq 0$ such that $g^c \notin \tilde{P}$. On the other hand, note that $\sigma/\theta < 1$ when $\eta_i[(N^*+1)^2 - (\eta_i+1)^2] + (N^* - \eta_i)(N^*\eta_i - 1) > 0$. But this holds for all $N^* > \eta_i > 0$. This completes the first part of the proof.

Consider now statement (ii). Because $CS_i(g^c) > CS_i(g^c - h_i)$ (the consumer surplus is link monotonic) and because the sign of $\pi_i(g) - \pi_i(g^c - h_i)$ is ambiguous as it depends on which effect, $CE(g^c - h_i)$ or $EE(g^c - h_i)$, is bigger, $W_i(g^c) \geq W_i(g^c - h_i)$ when consumer surplus is an important component of welfare. In other words, if $W_i(g^c) \geq W_i(g^c - h_i)$ holds when $a_i/b_i = 1$ for example, then it also holds when $a_i/b_i > 1$. Let us consider the case that $a_i/b_i = 1$. From (4) $\partial W_i(g^c - h_i)/\partial \eta_i = (\eta_i - 2)/(\eta_i+1)^3 + 1/(N^*+1)^2 > 0$ for all $\eta_i > 1$. This means that $W_i(g^c) > W_i(g^c - h_i)$ for all $a_i/b_i \geq 1$ when $N^* > \eta_i > 1$. Now consider the particular case that $\eta_i = 1$. From (3) and (4) we conclude that when countries are unbiased (so $a_i = b_i$) we have $W_i(g^c) - W_i(g_i^a) \Rightarrow N^{*2} + 2N^* - 3 > 0$ for all $N^* > 1$. We conclude, therefore, that $g^c \in \tilde{P}$ for all $a_i/b_i \geq 1$ and for all $\eta_i \geq 1$.

According to Proposition 1, it is always possible to find cases in which g^c is unstable under strongly pairwise stability because the condition $CE(g - h_i) > -EE(g - h_i)$ holds for some values of μ_i as explained above. To see that, consider the following example in which country i breaks all trade links. Simple calculation shows that $\pi_i(g^c) - \pi_i(g_i^a) = N^*/(N_i+1)^2 - 1/4 < 0$ for all $N^* > 1$. In this case the gain of domestic profit after breaking all links in g^c is large enough to overcome the loss of foreign profits. On the other hand, remember that $CS_i(g^c) > CS_i(g_i^a)$ for all $N^* > 1$. This implies that when $a_i/b_i \neq 0$, the government faces a trade off: breaking multiple links decreases consumer surplus but at the same time increases total profits. Therefore, when consumer surplus is under-represented in the welfare function (i.e., when $a_i/b_i < 1$), the trade off favors the strategy of breaking these multiple links. In contrast, when consumer surplus is equally or over-represented ($a_i/b_i \geq 1$), the trade off favors remaining in g^c.

Suppose now that $g^c \notin \tilde{P}$. Could g^c be stabilized under strongly pairwise stability? Before answering this question, note from Proposition 1 and (2) that

$g^c \notin \widetilde{P}$ implies that the marginal gain of total profit when breaking h_i links is larger than the marginal loss of consumer surplus. Formally, $b_i[\pi_i(g^c - h_i) - \pi_i(g^c)] > a_i[CS_i(g^c) - CS_i(g^c - h_i)] \geq 0$. This suggests that g^c can eventually be stabilized using a lump sum transfer, $T_i \geq 0$, from consumers to firms in network g^c such that:

$$a_i[CS_i(g^c) - T_i - CS_i(g^c - h_i)] \geq b_i[\pi_i(g^c - h_i) - \pi_i(g^c) - T_i] \geq 0$$

for all countries $i \in N$. In order to stabilize g^c and to be Pareto improving, this transfer has to satisfy the following inequalities:

$$CS_i(g^c) - T_i > CS_i(g^c - h_i) \quad (6)$$

$$\pi_i(g^c) + T_i > \pi_i(g^c - h_i). \quad (7)$$

Inequality (6) says that consumers, after providing the transfer in g^c, have to be better off in g^c than in $g^c - h_i$ and inequality (7) says that the domestic firm, after receiving the transfer in g^c, has to be better off in g^c than in $g^c - h_i$. According to these inequalities, such a transfer exists only when $CS_i(g^c) - CS_i(g^c - h_i) > T_i > \pi_i(g^c - h_i) - \pi_i(g^c)$. Let $\mu_i(g^c - h_i)$ be the cardinality of h_i when considering network $g^c - h_i$. In the following proposition we show that this inequality holds for any $\mu_i(g^c - h_i) > 0$. In other words, there always exists a transfer that prevents countries to deviate unilaterally from g^c.

Proposition 2: For any $\mu_i(g^c - h_i) > 0$ there exists a $T_i > 0$ such that $CS_i(g^c) - CS_i(g^c - h_i) > T_i > \pi_i(g^c - h_i) - \pi_i(g^c)$.

Proof: Note that $CS_i(g^c) = N^{*2} / 2(N^* + 1)^2$, $CS_i(g^c - h_i) = \eta_i^2 / 2(\eta_i + 1)^2$, $\pi_i(g^c) = N^* / (N^* + 1)^2$, and $\pi_i(g^c - h_i) = 1/(\eta_i + 1)^2 + (\eta_i - 1)/(N^* + 1)^2$. Using these definitions and simplifying terms, the inequality $CS_i(g^c) - CS_i(g^c - h_i) > \pi_i(g^c - h_i) - \pi_i(g^c)$ converges to $N^* > \eta_i$. Because of this result and because $\mu_i(g^c - h_i) = N^* - \eta_i$ when considering network $g^c - h_i$, we conclude that there always exists a transfer T_i satisfying $CS_i(g^c) - CS_i(g^c - h_i) > T_i > \pi_i(g^c - h_i) - \pi_i(g^c)$ for any $\mu_i(g^c - h_i) > 0$.

Proposition 2 tells us that, independent of any bias, there always exists a positive transfer T_i that can be financed from consumers such that each agent is better off in g^c than in $g^c - h_i$. Moreover, this transfer is independent of the number of links that can be broken from g^c. In other words, fixing an appropriate value for T_i is enough to ensure the stability of g^c. Nonetheless, this fixed value of T_i is affected by the government's bias when it is set at the cheapest value, where cheapest is defined in this paper as the smallest amount of consumer surplus that it is necessary to use as a transfer to ensure the stability of g^c. To see that, let $\overline{T}_i \geq 0$ be the cheapest fixed level of T_i. From Proposition 1 we know that when $a_i / b_i \geq 1$ we have $g^c \in \widetilde{P}$ without lump sum transfers. This means that when $a_i / b_i \geq 1$, the cheapest transfer has to be set at $\overline{T}_i = 0$. However, from the same proposition we know that when $0 \leq a_i / b_i < 1$ we have $g^c \notin \widetilde{P}$, and in this case a positive level of $\overline{T}_i$ is needed. Let $\tilde{h}_i$ be the link subset such that $\pi_i(g^c - \tilde{h}_i) - \pi_i(g^c) = \max[\pi_i(g^c - h_i) - \pi_i(g^c)]$. The fixed transfer $\overline{T}_i$ has to satisfy $a_i[CS_i(g^c) - \overline{T}_i - CS_i(g^c - \tilde{h}_i)] = b_i[\pi_i(g^c - \tilde{h}_i) - \pi_i(g^c) - \overline{T}_i]$ to ensure the stability of g^c at the cheapest level. That is, this is the transfer that makes the government indifferent between breaking $\tilde{h}$ links or remaining in g^c, when the maximum loss of total profits is $\pi_i(g^c) - \pi_i(g^c - \tilde{h}_i)$. Using this equality, rearranging terms, and considering Proposition 2, we conclude that:

$$\frac{\partial \overline{T}_i}{\partial b_i} = \frac{a_i}{(b_i - a_i)^2}\left\{\left[CS_i(g^c) - CS_i(g^c - \tilde{h}_i)\right] + \left[\pi_i(g^c - \tilde{h}_i) - \pi_i(g^c)\right]\right\} > 0. \qquad (8)$$

This expression tells us that the amount of consumer surplus used to finance $\overline{T}_i$ increases when governments are strongly biased in favor of their domestic firms. Nonetheless, even in the extreme case when this amount is maximum (i.e., when $a_i = 0$ and $b_i \neq 0$), consumers are better off in g^c than in $g^c - \tilde{h}_i$ because, according to Proposition 2, this $\overline{T}_i$ is Pareto improving.

5. Extensions

In this section we discuss extensions of the basic model.

5.1 Asymmetry

5.1.1 Asymmetry in Marginal Costs

Let us assume, without loss of generality, that all firms $j \neq i$ face a marginal cost equal to $\gamma = \alpha/2$, that $\alpha = 2$, and that firm i faces a marginal cost equal to $\gamma_i \neq \gamma$. Let $\lambda_i = (\alpha - \gamma_i)/(\alpha - \gamma) \subset \mathbb{R}^+$ be a parameter representing the asymmetry in γ_i such that $\lambda_i \in [0,2]$. If country i is efficient with respect to the rest of the world (so that $\gamma_i < \gamma$), then $\lambda_i \in (1,2]$, and if this country is inefficient (so that $\gamma_i > \gamma$), then $\lambda_i \in [0,1)$. Note that $\lambda_j = 1$ for all $j \neq i$. Finally, let us assume that firms play Cournot competition in all markets.

The total equilibrium output of firm i in country i is $Q_i^i = [\eta_i(\lambda_i - 1) + 1]/(\eta_i + 1)$ when $\lambda_i \geq 1 - 1/\eta_i$ and is $Q_i^i = 0$ when $\lambda_i < 1 - 1/\eta_i$ (this latter restriction is introduced to avoid negative output). Likewise, the total output in equilibrium of firm j in country i is $Q_i^j = (2 - \lambda_i)/(\eta_i + 1)$ when $\lambda_i \in [0,2]$. Finally, the total equilibrium output in country i is $Q_i(g) = (\eta_i + \lambda_i - 1)/(\eta_i + 1)$. Using these expressions we obtain the following results: (i) $CS_i(g) = (\eta_i + \lambda_i - 1)^2/2(\eta_i + 1)^2$ when $2 > \lambda_i > 1 - 1/\eta_i$, (ii) $\pi_i(g^c) = N^*[N^*(\lambda_i - 1) + 1]^2/(N^* + 1)^2$ when $2 > \lambda_i > 1 - 1/N^*$ and $\pi_i(g^c) = 0$ when $\lambda_i < 1 - 1/N^*$, (iii) $\pi_i(g_i^a) = \lambda_i^2/4$, (iv) $CS_j(g) = (\eta_j + \lambda - 1)^2/2(\eta_j + 1)^2$ when $g_{ij} = 1$ and when $2 > \lambda_i > 1 - 1/\eta_j$, (v) $CS_j(g) = \eta_j^2/2(\eta_j + 1)^2$ when $g_{ij} = 0$, (vi) $\pi_j(g^c) = N^*(2 - \lambda_i)^2/(N^* + 1)^2$ when $\lambda_i \in [0,2]$, and (vii) $\pi_j(g_j^a) = 1/4$.

It is clear from these expressions that the world economy is affected when a firm is asymmetric in terms of marginal costs. If a firm is efficient, it displaces its competitors by expropriating profits from them. Conversely, when a firm is inefficient, it is displaced by its competitors. On the other hand, (i) and (iv) tell us that consumers are always benefited (harmed) in terms of consumer surplus when there is an efficient (inefficient) firm in the domestic market. This firm increases (reduces) total production reducing (increasing), in this way, market power.

Stability of global free trade under asymmetry depends basically on the same factors described in the last section: (i) consumer surplus, (ii) domestic profit (the competition effect), and (iii) foreign profits (the expansion effect). However, these factors are influenced by the displacement effect exercised by the domestic firm of the asymmetric country.

In this subsection we simplify the analysis in order to show particular deviations from global free trade. Moreover, we only consider extreme cases in terms of government bias. Nonetheless, these simplifications provide interesting results without excessively complicating the model.

(a) Consumer surplus. Assume that $b_k = 0$ for all $k \in N$. It is straightforward to show from (i), (iv), and (v) that $CS_k(g) > CS_k(g - h_k)$ for all $\mu_k > 0$, for all $k \in N$, and for all $\lambda_i \in [0,2]$ when the restrictions are all satisfied. Thus, if $b_k = 0$ in (1), countries will create as many links as possible because their domestic markets become more competitive, positively affecting consumer surplus. This implies that the unique strongly pairwise stable network in this case is g^c.

(b) Profits. Assume that $a_k = 0$ for all $k \in N$. Then g^c is not stable because $\pi_j(g_j^a) = 1/4 > \pi_j(g^c) = N^*(2-\lambda_i)^2/(N^*+1)^2$ holds for all $\lambda_i \in [0,2]$ when $N^* > 14$. Also, $\pi_i(g_i^a) > \pi_i(g^c)$ when country i is inefficient in this case. However, $\pi_j(g^c) > \pi_j(g_j^a)$ when country i is inefficient and when $N^* < 14$. This implies that g^c cannot be stable. The intuition of this result can be understood by considering the following partial analysis. From (ii), (iii), (vi), and (vii) it is possible to establish that (a) $\lim_{\lambda_i \to 2}[\pi_i(g_i^a) - \pi_i(g^c)] < 0$, (b) $\lim_{\lambda_i \to 2}[\pi_j(g_j^a) - \pi_j(g^c)] > 0$, and (c) $\lim_{\lambda_i \to 1-1/N^*}[\pi_i(g_i^a) - \pi_i(g^c)] > 0$. That is, if the domestic firm in country i is highly efficient (so that $\lambda_i \to 2$), it benefits from additional links because it is able to expropriate profits from its competitors. However, because firm j is strongly displaced by firm i in all markets where they compete and because the competition effect dominates the expansion effect in the former when considering networks g_j^a and g^c, firm j is better off in autarky than in g^c. In contrast, if the domestic firm in country i is highly inefficient, then it is completely displaced by its competitors in g^c (i.e., $\pi_i(g^c) = 0$) when $\lambda_i \le 1-1/N^*$. Thus, this firm is better off in autarky because it can make positive profits (i.e., $\pi_i(g_i^a) > 0$) even when $0 < \lambda_i \le 1-1/N^*$.

5.1.2 Asymmetry in Market Size

In this part we assume that country i is asymmetric in market size. That is, $\alpha_i \ne \alpha$ for country i, and $\alpha_j = \alpha$ for all $j \in N - \{i\}$. If $\alpha_i > \alpha$ ($\alpha_i < \alpha$), then country i is large (small) in market size.

Network g^c is strongly pairwise stable under asymmetry in market size when the following conditions hold for country i and for all countries $j \in N - \{i\}$:

$$\begin{aligned} W_i(g^c) - W_i(g^c - h_i) = a_i(\alpha_i - \gamma)^2 \left[\widetilde{CS}_i(g^c) - \widetilde{CS}_i(g^c - h_i) \right] \\ + b_i(\alpha_i - \gamma)^2 \left[\tilde{\pi}_i^i(g^c) - \tilde{\pi}_i^i(g^c - h_i) \right] \\ + b_i(\alpha - \gamma)^2 \left[\tilde{\pi}_{-i}^i(g^c) - \tilde{\pi}_{-i}^i(g^c - h_i) \right] > 0 \end{aligned} \tag{9}$$

$$\begin{aligned} W_j(g^c) - W_j(g^c - h_j) = a_j(\alpha - \gamma)^2 \left[\widetilde{CS}_j(g^c) - \widetilde{CS}_j(g^c - h_j) \right] \\ + b_j(\alpha - \gamma)^2 \left[\tilde{\pi}_j^j(g^c) - \tilde{\pi}_j^j(g^c - h_i) \right] \\ + b_j(\alpha_i - \gamma)^2 \left[\tilde{\pi}_i^j(g^c) - \tilde{\pi}_i^j(g^c - h_i) \right] \\ + b_j(\alpha - \gamma)^2 \left[\tilde{\pi}_{-j,i}^j(g^c) - \tilde{\pi}_{-j,i}^j(g^c - h_i) \right] > 0, \end{aligned} \tag{10}$$

where $(\alpha-\gamma)^2 \tilde{\pi}_{-i}^i(g^c)$ and $(\alpha-\gamma)^2[\tilde{\pi}_i^j(g^c) + \tilde{\pi}_{-j,i}^j(g^c)]$ are the total profits that firms i and j make abroad (see subsection 2.2 for a formal description).

It is straightforward to show that the first condition is not always satisfied when country i is very big (in the sense that $\alpha_i > \gamma$ and $\alpha \approx \gamma$), as making profits abroad is not relevant for the domestic firm of this country. Moreover, this is true even for an unbiased country. As an example, note that when $a_i = b_i$ and $\alpha = \gamma$, $W_i(g^c) \le W_i(g_i^a)$ for all $N^* \le 5$. On the other hand, (10) tells us that when country i is very large, all countries $j \ne i$ have an incentive to form an agreement with the former because of the large level of profits that firm j can make in country i.

When country i is very small (in the sense that $\alpha_i \approx \gamma$ and $\alpha > \gamma$), the domestic firm of this country makes a larger profit abroad than in the domestic market, and the incentive to remain in g^c increases. This can be seen since from (9) $\lim_{\alpha_i \to \gamma}[W_i(g^c) - W_i(g^c - h_i)] = b_i(\alpha-\gamma)^2[\tilde{\pi}_{-i}^i(g^c) - \tilde{\pi}_{-i}^i(g^c - h_i)] > 0$. In other words, only the expansion effect is relevant when $\alpha_i \to \gamma$. This means that even when a small country is biased in favor of its domestic firm, this country will tend to form international agreements with large countries. Country j, on the other hand, is not strongly affected when breaking a link with the small country because the latter has only a small domestic market in which to make profits.

From this analysis we conclude that g^c can be unstable when there is a large country in the world. Moreover, the incentive of this country to deviate from g^c increases when its government is biased in favor of the domestic firm.

5.2 Endogenous Tariffs

In Section 3 we define three sets of equilibrium networks: (1) strongly pairwise stable networks ($\tilde{P}$), (2) pairwise stable networks (P), and (3) Nash equilibrium networks (NE). On the other hand, we explain in the introduction that Goyal and Joshi (2006) find that global free trade is pairwise stable for the case of unbiased countries (i.e., $g^c \in P$), and Yi (2000) find, using a similar framework, that global free trade is not stable under a standard Nash equilibrium concept derived from a simultaneous-move open regionalism game (i.e., $g^c \notin NE$). Because $\widetilde{P} = P \cap NE$ (see Section 3), we conclude that global free trade is not strongly pairwise stable when countries are unbiased and when tariffs are endogenous (i.e., $g^c \notin \widetilde{P}$). The reason is that the optimal tariff rate is a decreasing function of the number of links existing in a country; see equation (28) in Goyal and Joshi (2006). Thus, country i can obtain a considerable amount of tariff revenue when deviating from global free trade by charging a high tariff to the rest of the countries but paying a small tariff rate to them. This large tariff revenue plus the gain of additional profits in the domestic market after breaking these links are big enough to compensate the loss of both consumer surplus and foreign profits.

Unfortunately, it is difficult to determine whether a transfer can be used to stabilize g^c given the associated mathematical complexity (a fact also noted by Goyal and Joshi, 2006, p. 768). However, we partially extend this analysis using the following welfare function:

$$W_i(g) = a_i CS_i(g) + b_i \pi_i(g) + c_i TR(g)_i \tag{11}$$

where c_i (with $0 \le c_i \le 1$) is the weight that the government puts on tariff revenue $TR(g)_i$.

(a) Consumer surplus. Assume that $a_i = 1$ and $b_i = c_i = 0$. Letting $t_i(g)$ denote the tariff rate in network g, from equation (27) of Goyal and Joshi (2006), welfare becomes (i) $W_i(g^c) = CS_i(g^c) = [N^*(\alpha - \gamma)]^2 / 2(N^* + 1)^2$ and (ii) $W_i(g^c - h_i) = CS_i(g^c - h_i) = [N^*(\alpha - \gamma) - \mu_i(g^c - h_i) t_i(g^c - h_i)]^2 / 2(N^* + 1)^2$. In this case $W_i(g^c) > W_i(g^c - h_i)$ for all $\mu_i(g^c - h_i) > 0$ and all $t_i(g^c - h_i) > 0$. Because all countries are symmetrical, this result implies that $g^c \in \widetilde{P}$. In fact, if a country deviates from g^c, its ex-partner countries have to pay a tariff rate, thereby increasing the market power of the domestic market of the former. But this larger market power reduces consumer surplus.

(b) Tariff revenue. Assume now that $a_i = b_i = 0$ and $c_i = 1$. Again using equation (27) of Goyal and Joshi (2006), welfare becomes $W_i(g^c - h_i) = TR_i(g^c - h_i) = \mu_i(g^c - h_i) t_i(g^c - h_i)[(\alpha - \gamma) - (\eta_i + 1) t_i(g^c - h_i)] / (N^* + 1)$. Simple calculation shows that the tariff rate that maximizes tariffs revenue and the optimum tariff revenue in $g^c - h_i$ are $t^*(g^c - h_i) = (\alpha - \gamma) / 2(\eta_i + 1)$ and $TR^*(g^c - h_i) = \mu_i(g^c - h_i)(\alpha - \gamma)^2 / 4(\eta_i + 1)(N^* + 1)$. Because $\partial W_i^*(g) / \partial \eta_i = \partial TR(g)^* / \partial \eta_i < 0$, we conclude that $g^c \notin \widetilde{P}$. The intuition of this result is straightforward. Additional agreements imply fewer countries to be taxed by tariff rates. Thus, a country can obtain the global maximum tariff revenue in autarky. On the other hand, it is possible to stabilize g^c using a lump sum transfer T_i such that $CS_i(g^c) - CS_i(g^c - h_i) > T_i > TR_i(g^c - h_i)$. Simple algebra shows that this inequality holds when $t_i(g^c - h_i) > 2(\alpha - \gamma) / [2(N^* + 1)(\eta_i + 1) - \mu_i(g^c - h_i)] = \widetilde{t}_i(g^c - h_i)$. Now, because $t^*(g^c - h_i) > \widetilde{t}_i(g^c - h_i)$ when $2(\eta_i + 1)(N^* + 1) > N^* - \eta_i$, we conclude that g^c can always be stabilized by using a intra-node transfers. Note, however, that this transfer is not Pareto improving because firms are not necessarily better off in g^c. Moreover, is difficult to justify such a transfer in order to maintain the revenue of the government. The beneficial effect of this transfer will depend, therefore, on how the government uses this tariff revenue.

(c) Profits. Finally, assume $a_i = c_i = 0$ and $b_i = 1$. Again using equation (27) of Goyal and Joshi (2006), we define (i) $\pi_i^i(g^c) = (\alpha-\gamma)^2 \big/ (N^*+1)^2$, (ii) $\pi_i^i(g^c - h_i) = [(\alpha-\gamma) + \mu_i(g^c - h_i)t_i(g^c - h_i)]^2 \big/ (N^*+1)^2$, and (iii) $\pi_j^j(g^c - h_i) = [(\alpha-\gamma) + t_j(g^c - h_i)]^2 \big/ (N^*+1)^2$. According to these expressions, it is always optimal for country i to establish prohibitive tariffs when breaking $\mu_i(g^c - h_i)$ agreements, and it is always optimal for countries $j \neq i$ to impose prohibitive tariffs for country i. The reason is that both countries can increase domestic profits by increasing market power. But this means that in this case $g^c \notin \widetilde{P}$. Moreover, the model converges to that of exogenous tariffs with biased countries in favor of domestic firms. This also means that g^c can be stabilized by using a Pareto improving transfer as we show in Proposition 2.

6. Conclusions

This paper studies whether bilateralism is consistent with global free trade by introducing strongly pairwise stability into the theoretical framework of Goyal and Joshi (2006). We believe that this stability notion is more appropriate than pairwise stability (the stability concept used by these authors) to study international trade networks because it allows countries to break more than one international agreement at the same time, a fact that reflects the real possibilities of governments involved in bilateral agreements. Strongly pairwise stability is also preferred to the traditional non-cooperative Nash equilibrium concept because the latter allows for unrealistic network equilibriums (Bloch and Jackson, 2006).

Using strongly pairwise stability we find four main results: (1) global free trade is unstable in many situations associated with government bias in favor of domestic firms when tariffs are determined exogenously and when countries are symmetrical, (2) when considering asymmetry in marginal costs, global free trade is unstable when government bias favors domestic firms, (3) when considering asymmetry in market size, if a country is big, global free trade is unstable when governments are unbiased and when the size of the network is small (i.e., less than 5 countries), and global free trade is always unstable when the government over the large market is biased in favor of domestic firms, and (4) when tariff rates are endogenous, global free trade is unstable when governments are either unbiased, biased in favor of domestic firms, or biased in favor of tariff revenue. Given these results, we conclude that bilateralism is not necessarily consistent with global free trade under strongly pairwise stability. However, a system of transfers financed from consumers (intra-node transfers) could be used to stabilize this efficient condition: (1) if tariff rates are exogenous, there always exits a Pareto improving transfer that can be used to stabilize global free trade and (2) if tariff rates are endogenous, it could be possible in some cases to find a stabilizing transfer but it is not necessarily Pareto improving. This finding suggests that bilateralism could be considered as a building step toward a liberal world trade system when governments can use intra-node transfers. Nonetheless, more research is needed to determine whether this is always a feasible policy when tariffs are endogenous.

An interesting extension of our research would be the use of strongly pairwise stability in a reformulated version of the work of Furusawa and Konishi (2007). That is, in a version in which governments are allowed to have political bias. Nonetheless, even in the original model of these authors it is possible to see that global free trade is not necessarily strongly pairwise stable. In fact, these authors recognize that the free rider problem studied by Yi (2000) is also present in their network model when tariffs are endogenous. Regarding this point, Furusawa and Konishi (2007) argue: "A similar result is expected to obtain in our extended model, i.e., there may be an asymmetric incomplete stable FTA network such as only one country is isolated from the rest of the countries. Nevertheless, as Remark 2 indicates, the complete FTA network continues to be stable even if external tariffs are optimally adjusted" (p. 330). The observation of Furusawa and Konishi (2007) is correct in that global free trade is pairwise stable as stated in Remark 2 of their paper. However, the result of Yi (2000) allows us to infer that global free trade is not strongly pairwise stable as the Nash equilibrium concept used by him implies strongly pairwise stability.

References

Baldwin, R., (1987), "Politically Realistic Objective Functions and Trade Policy," *Economic Letters*, 24, 287-290.

Becker, G., (1983), "A Theory of Competition among Pressure Groups for Political Influence," *The Quarterly Journal of Economics*, 98(3), 371-400.

Bloch, F. and M. O. Jackson, (2006), "Definitions of Equilibrium in Network Formation Games," *International Journal of Game Theory*, 34, 305-318.

Furusawa, T. and H. Konishi, (2005), "Free Trade Networks with Transfers," *Japanese Economic Review*, 56, 144-164.

Furusawa, T. and H. Konishi, (2007), "Free Trade Networks," *Journal of International Economics*, 72, 310-335.

Gardner, B., (1987), "Causes of U.S. Farm Commodity Programs," *Journal of Political Economy*, 95(2), 290-310.

Gilles, R. P. and S. Sarangi, (2004a), "Social Network Formation with Consent," *CentER Discussion Paper*, No. 2004-70.

Gilles, R. P. and S. Sarangi, (2004b), "The Role of Trust in Costly Network Formation," mimeo: Virginia Tech.

Gilles, R. P. and S. Sarangi, (2005), "Stable Networks and Convex Payoffs," *CentER Discussion Paper*, No. 2005-84.

Goyal, S. and S. Joshi, (2006), "Bilateralism and Free Trade," *International Economic Review*, 47(3), 749-778.

Jackson, M. and A. Wolinsky, (1996), "A Strategic Model of Social and Economic Networks," *Journal of Economic Theory*, 71(1), 44-74.

Jackson, M. and A. Wolinsky, (2004), "A Survey of Network Formation Models: Stability and Efficiency," in *Group Formation in Economics: Networks, Clubs and Coalitions*, G. Demange and M. Wooders eds., Cambridge, U.K.:

Cambridge University Press.

Myerson, R., (1991), *Game Theory: Analysis of Conflict*, Cambridge, MA: Harvard University Press.

Yi, S., (1996), "Endogenous Formation of Customs Unions under Imperfect Competition: Open Regionalism Is Good," *Journal of International Economics*, 41, 153-177.

Yi, S., (2000), "Free-Trade Areas and Welfare: An Equilibrium Analysis," *Review of International Economics*, 8(2), 336-347.