

Board of Governors of the Federal Reserve System

International Finance Discussion Papers

Number 680

September 2000

SPAGHETTI REGIONALISM

Caroline L. Freund

NOTE: International Finance Discussion Papers are preliminary materials circulated to stimulate discussion and critical comment. References in publications to International Finance Discussion Papers (other than an acknowledgment that the writer has had access to unpublished material) should be cleared with the author or authors. Recent IFDPs are available on the Web at [www.bog.frb.fed.us](http://www.bog.frb.fed.us).

## SPAGHETTI REGIONALISM

Caroline L. Freund\*

**Abstract:** This paper examines the welfare implications of multiple free trade agreements in a model of imperfect competition. We show that free trade is the unique Nash equilibrium under the simple rule that any two countries can form a bilateral free trade agreement. Specifically, a country is always better off forming a bilateral trade agreement with every other country, irrespective of previous agreements. This suggests that each new preferential free trade agreement may be a step towards multilateral free trade.

**Keywords:** trade, regionalism, and imperfect competition

\*Economist in the International Finance Division of the Federal Reserve Board. I would like to thank Pravin Krishna and Marcelo Olarreaga for helpful comments. Correspondence: Caroline Freund, International Finance Division, Federal Reserve Board, Washington D.C. 20551, e-mail: caroline.l.freund@frb.gov. The views presented here are solely the responsibility of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or any other person associated with the Federal Reserve System.

# 1 Introduction

Many countries have signed multiple free trade agreements. The United States has preferential trade agreements with Israel, Canada, Mexico, and several nations in the Caribbean. Mexico has free trade agreements with the United States, Canada, Bolivia, Costa Rica, and Chile. Chile has trade agreements with Mexico, Venezuela, Colombia, Canada, and the Mercosur trade bloc. European countries have signed on to numerous free trade agreements as well. More than 30 trade agreements among and between several of the Central and Eastern European countries and members of European Union and European Free Trade Association were ratified between 1992 and 1995.

The question we address in this paper is whether this “spaghetti bowl” of regional agreements, as Jagdish Bhagwati (1993) has called it, will lead to free trade. Taking the tariff level as fixed, we solve for the optimal number of bilateral free trade agreements that a country will participate in. We find that free trade will always be achieved under the simple rule that any bilateral trade agreement (BTA) is permitted. Specifically, in a three-country model with imperfect competition and symmetric tariffs, we show that a country that is a member of one bilateral agreement is always better off signing a second BTA, and a country that is not a member of the initial BTA is always better off signing a separate agreement with each of the incumbents. Hence, the strictly dominant strategy for each country is to have a bilateral agreement with all other countries, and the unique Nash equilibrium is one where all country pairs have free trade. We show that this result extends to a  $n$ -country model. This implies that the regional path will always lead to free trade, provided countries are permitted to sign more than one bilateral free trade agreement.

This finding is in contrast to much of the recent literature on whether regionalism help or hinder the free trade process.<sup>1</sup> One strand of literature examines the effect of a single regional

---

<sup>1</sup>See Panagariya (2000) for a survey of the theoretical literature.

agreement on the members' incentives for multilateral tariff reduction. Grossman and Helpman (1995), Panagariya and Findlay (1996), Levy (1997), and Krishna (1998) find that the political support for multilateral free trade declines subsequent to the formation of a preferential trade agreement. The logic in these models is that special interest groups lose the preferential treatment in their own market as well as the preferential treatment in the other member's market if free trade is achieved. Without the trade bloc, interest groups have only the preferential treatment in their own market to lose. Thus, if the preferential trade agreement is supported by special interests groups, it must make their support for free trade wane.

A second strand of literature analyses whether the expansion of an existing regional agreement will lead to free trade. Baldwin (1995) and Yi (1996) find that non-members have more incentive to join a regional agreement as it expands. The intuition is that as the free trade area grows, the cost to a non-member of remaining outside the agreement also grows, implying that a non-member will have a greater incentive to join the union as it expands. But, Bond and Syropoulos (1996) and Yi (1996) show that the members of a union will not have an incentive to permit all other countries to join. Once the preferential trade area is large enough, the loss of preferential treatment in each others' markets outweighs the efficiency gain from accepting a new member. They find that the welfare of incumbents is maximized when some, but not all, countries are members of the union.

The model in this paper shows that allowing for separate bilateral agreements unhinges this intuition because signing a second bilateral agreement does not affect preferential treatment in the other member's market. Specifically, while a pair of countries can be jointly better off with a positive external tariff, each member is always individually better off if it bilaterally agrees to free trade with a third party. Thus, the regional outcome is not a Nash equilibrium because each country has an incentive to submit to other bilateral free trade agreements. This has the important policy implication that, if free trade is the desired outcome, no bloc member should be able to

prevent another bloc member from committing to free trade with a third party.

While the results suggest that regionalism may be a viable alternative to multilateral tariff reduction, they should not be interpreted as implying that bilateralism is *better* than multilateral tariff reduction. In particular, the model is static. In reality there are costs associated with having an abundance of BTAs during the transition to free trade that we do not evaluate. For example, as Bhagwati and Panagariya (1996) highlight, a multitude of agreements will cause complex rules of origin to find their way into practice. In addition, if the incumbent members of a free trade agreement can enforce cooperation among themselves then they might be able to block the free trade outcome. In this case, a small number of exclusive agreements could be maintained. Finally, regionalism is still a questionable policy as compared with multilateralism. Theory suggests that it may help or hinder the free trade process, and of course there is the danger of welfare-reducing trade diversion as a result of regionalism. Still, if regionalism prevails, as seems to be the case presently, it is comforting to know that a “spaghetti bowl” of free trade agreements may very well lead to free trade, and that it is more likely to bring about free trade than a small number of distinct trade blocs.

This paper is divided into four sections. Section 2 describes the basic three-country model. Section 3 generalizes the model to allow for a larger number of countries in the rest of the world. Section 4 concludes.

## **2 II. A Three-Country Model**

In this section, we use a three-country oligopolistic model of trade to examine the optimal number of bilateral agreements. This model is appropriate for analyzing trade bloc questions because optimal tariffs are non-zero and because regional agreements expand the members’ share of the world market and hence enhance profits abroad. Krishna (1998) employs an oligopolistic model to show

that this profit effect can reduce the incentive for multilateral free trade if the government cares relatively more about producers' welfare. Freund (2000) shows that even with a welfare-maximizing government there exists a positive external tariff such that member countries can attain a higher welfare level than they would at free trade. Thus, in this model, regionalism seems a priori likely to hinder the move to free trade.

There is one good which is produced by a single profit-maximizing firm in each country and segmented markets lead to trade in this good (as in Brander and Krugman (1983) and Brander and Spencer (1984)). There are three countries  $X$ ,  $Y$ , and  $Z$ .

We assume that the inverse demand function,  $P^i(Q)$ , in each country is linear. Specifically,

$$P^i(Q) = 1 - aQ^i \text{ and } Q^i = q_x^i + q_y^i + q_z^i, \quad (1)$$

where  $a$  is a constant,  $Q^i$  is the total quantity consumed in country  $i$ , and  $q_j^i$  is the quantity produced by the firm in  $j$  for market  $i$ . Competition is Cournot. Profits to the firm from country  $X$ , in country  $i$ ,  $\pi^i$ , are

$$\pi^i = x^i P^i(Q^i) - cq_x^i - t_x^i q_x^i, \quad (2)$$

where,  $c$  is a constant marginal cost of production, and  $t_j^i$  is the tariff that the firm from country  $j$  faces in market  $i$  ( $t_i^i = 0$  and  $t_i^j \geq 0$ ). Solving for the profit maximizing quantity of a firm from country  $X$  in market  $i$ , we have

$$q_x^i = \frac{1 - c + t_x^i - 3t_x^i}{4a}. \quad (3)$$

A sufficient condition for each firm to sell in each market is that  $t_j^i < \frac{(1-c)}{3}$ .

The government's welfare function,  $W$ , in country  $X$ , is the sum of consumer surplus, producer surplus, and tariff revenue.

$$W = U(Q) - P^x Q + \sum_{i=x,y,z} (x^i P^i - cx^i - t_x^i q_x^i) + t_y^x q_y^x + t_z^x q_z^x. \quad (4)$$

In equation (4),  $U(Q)$  is the consumer utility from that quantity. Plugging in the profit maximizing quantities from equation (3), we have

$$\begin{aligned}
W &= \frac{(3(1-c) - t_y^x - t_z^x)^2}{32a} + \sum_{i=x,y,z} \frac{\left(1 - c + \sum_{j=y,z} t_j^i - 3t_x^i\right)^2}{16a} \\
&+ t_y \left(\frac{1 - c + t_z^x - 3t_y^x}{4a}\right) + t_z \left(\frac{1 - c + t_y^x - 3t_z^x}{4a}\right),
\end{aligned} \tag{5}$$

where the first term is consumer surplus, the second term is producer surplus, and the last two terms are tariff revenue.

If there are no free trade agreements then the government maximizes welfare, equation (5), over  $t_y^x$  and  $t_z^x$ , taking other countries' tariffs as given. With symmetric countries, the tariff on  $Y$  will be equivalent to the tariff on  $Z$ , resulting in an optimal tariff of

$$t^* = \frac{3(1-c)}{10}.$$

Note that, in this model, the optimal tariff in one country is not a function of the tariffs implemented abroad. This implies that regardless of what policy other countries follow, a single country is always better off with a positive tariff. However, if each country installs its optimal tariff then they are all worse off than they would be at free trade. Each country is made better off if some reciprocal bilateral or multilateral tariff reduction is achievable.

## 2.1 Bilateral Agreements

In this section, we examine the incentive for a country to join a bilateral free trade agreement, considering all possible permutations of bilateral agreements that could exist in a three-country model. With three countries, it is only sensible focus on bilateral agreements; however, our reasons for considering only BTAs are somewhat more general. A country can always agree to an additional bilateral trade agreement, no matter how many agreements it is a member of or whether it is a

member of a large trade bloc. Evaluating multiple bilateral agreements, therefore, effectively allows for all possible permutations of trade agreements, and it is the most straight-forward method to determine the outcome when multiple overlapping free trade agreements exist.

For simplicity, we assume the game is a simultaneous move game, each country decides how many bilateral agreements to join, then all BTAs, where both members want an agreement, are formed. The outcome does not depend on simultaneous moves, it only requires that there is no cooperation among members of one agreement, such that they can prevent each other from forming an additional free trade agreement.<sup>2</sup>

Without loss of generality, we assume that tariffs are positive but not above the prohibitive level ( $0 < t \leq \frac{1-c}{3}$ ). We assume the tariff is greater than zero because if  $t$  equals zero a bilateral agreement has no effect and the problem is not interesting. We assume the tariff level is less than or equal to the prohibitive level in order to prevent negative quantities from entering the welfare function. If the tariff is above the prohibitive level, welfare is exactly equal to its value at the prohibitive level—there is no marginal effect on welfare of a tariff increase beyond the prohibitive level. We further assume that all positive tariffs are symmetric (i.e. if a country has a positive tariff on another country it is  $t$ ) and that external tariffs are part of an exogenous multilateral agreement and therefore do not change as the result of the formation of a bilateral agreement.<sup>3</sup> This assumption

---

<sup>2</sup>Yi (1996) examines the equilibrium size of a free trade area if members act as a coalition and can prevent non-members from joining the trade bloc.

<sup>3</sup>Ethier (1998) and Freund (2000) also treat regionalism as endogenous with respect to the tariff level. They consider the incentives to join a single regional agreement, as a function of the tariff level. Ethier (1998) finds that a small country can more easily achieve reform after linking up with a large country because the small country will have a marginal advantage over other small countries in attracting foreign direct investment. When tariffs are low, the value of foreign investment is greater, making small countries more eager to sign free trade agreements. In a model with imperfect competition, Freund (2000) shows that at a low tariff level, both preferential and multilateral tariff reduction have a similar pro-competitive effect, but preferential agreements are relatively less costly because

is justified by tariff determination within the World Trade Organization (WTO). Members of the WTO face constraints that rule out preferential tariff reductions, apart from complete liberalization. In addition, the formation of a new regional agreement is conditional on external tariffs remaining unchanged at the most favored nation level, subsequent to the formation of a preferential trade agreement.

To endogenize the number of bilateral agreements, we evaluate the welfare of a representative country, say  $X$ , with all possible bilateral agreements in the world. With three countries, there are three possible bilateral agreements, for each we assign an indicator variable  $I_{ij}$ , which is one if  $i$  and  $j$  have a bilateral agreement and zero otherwise. From equation (5)  $X$ 's welfare is

$$\begin{aligned}
W = & \frac{(3(1-c) - (2 - I_{xy} - I_{xz})t)^2}{32a} + \frac{(1-c + (2 - I_{xy} - I_{xz})t)^2}{16a} + \frac{(1-c + (1 - I_{yz})t - 3(1 - I_{xy})t)^2}{16a} \\
& + \frac{(1-c + (1 - I_{yz})t - 3(1 - I_{xz})t)^2}{16a} + (2 - I_{xy} - I_{xz})t \left( \frac{1-c - (2 + I_{xy} + I_{xz})t}{4a} \right), \tag{6}
\end{aligned}$$

where the first term on the right-hand side is consumer surplus, the second term is  $X$ 's profits in the home market, the third term is  $X$ 's profits in  $Y$ 's market, the fourth term is  $X$ 's profits in  $Z$ 's market, and the last term is tariff revenue. Signing a BTA with  $Y$ , for example, affects all of the terms except profits in country  $Z$ . As a result of the agreement, the firm from  $Y$  exports more to  $X$ , which makes consumer surplus (the first term) increase and domestic profits (the second term) fall. Profits in  $Y$ 's market (the third term) increase because the tariff facing  $X$  in  $Y$ 's market is removed. Profits in  $Z$ 's market (the fourth term) do not change since  $Z$ 's tariff preferences on  $X$  and  $Y$  does not change as a result of the bilateral agreement between  $X$  and  $Y$ . Tariff revenue declines because  $Y$  has duty free access.

From equation (6) we can calculate  $X$ 's welfare from having BTAs with  $Y$  and  $Z$  under all possible permutations of other agreements. Specifically, with respect to country  $X$ , there are 6 possible outcomes. (i) There are no BTAs. (ii) There is only one BTA and  $X$  is a member. (iii) profits and tariff revenue fall by less. This also makes preferential trade agreements more likely when tariffs are low.

There is only one BTA and  $X$  is not a member. (iv) There are two BTAs and  $X$  is a member of both. (iv) There are two BTAs and  $X$  is a member of one. And (vi), all pairs of countries have a BTA—which is effectively free trade. We now examine the welfare of  $X$  under each of these scenarios, which by symmetry is the same as the welfare of each other country in that scenario.

The columns in Table 1 show  $X$ 's payoff from not joining a BTA, from joining one BTA, and from having bilateral agreements with both  $X$  and  $Y$ , as compared with the case where there are no agreements in the world (i.e. where  $I_{ij} = 0$ , for all  $i$  and  $j$ ). The first row shows  $X$ 's payoff, assuming there is no bilateral agreement between  $Y$  and  $Z$  ( $I_{yz} = 0$ ). In this case,  $X$  is better off signing a bilateral agreement with both  $Y$  and  $Z$ . The second row shows  $X$ 's payoff when  $Y$  and  $Z$  have a bilateral agreement ( $I_{yz} = 1$ ). Again, country  $X$  is better off having an agreement with both  $Y$  and  $Z$ . Thus, the strictly dominant strategy for country  $X$  is to have a bilateral agreement with both  $Y$  and  $Z$ . Since the game is symmetric, each country's best strategy is to agree to two bilateral agreements and effectively there will be multilateral free trade.

Note that this is not always the welfare maximizing strategy. At low tariff levels, if there is only one bilateral agreement, the two members are better off than they would be at free trade. Specifically, the value of being a member of the single free trade agreement is greater than the value of multilateral free trade, (the value in the first row and second column of Table 1 is greater than the value in the bottom right) when the tariff level is less than  $\frac{2(1-c)}{11}$ .<sup>4</sup> This result, that two countries in a regional agreement can be better off than at free trade and thus might not have an incentive to liberalize multilaterally, is the result that others have focused on. But, provided any bilateral agreement is permitted, maintaining one regional agreement is not a Nash equilibrium because each member is always better off having an agreement with the third party no matter what

---

<sup>4</sup>Kennan and Riezman (1990) also show that members of a large customs union can be better off with the union than at free trade.

the other member does, and the third party will be willing to sign both agreements.

Table1: Feasible Strategies

	No agreement	$X$ signs 1 agreement	$X$ signs 2 agreements
$Y$ and $Z$ have no agreement	0	$t \frac{6(1-c)-7t}{32a}$	$t \frac{12(1-c)+8t}{32a}$
$Y$ and $Z$ have a bilateral agreement	$-t \frac{8(1-c)-20t}{32a}$	$-t \frac{2(1-c)-t}{32a}$	$t \frac{4(1-c)+4t}{32a}$

With symmetric external tariffs and three countries, if any bilateral agreement is enforceable, free trade is the unique Nash outcome. The logic is simple and is likely to carry over to other models. The advantage of a bilateral agreement is that it gives each member preferential treatment in the other member's market. This means that profits abroad increase and supply in the domestic market expands so consumer surplus goes up. The disadvantage is that domestic profits and tariff revenue fall because the other member has duty-free access at home. We have shown that the effect on profits abroad and on consumer surplus always outweigh the effect on domestic profits and tariff revenue. This implies that any two countries always have the incentive to sign a bilateral free trade agreement. Thus, if any bilateral agreement is permitted, maintaining a single bilateral agreement is not a Nash equilibrium since each member has the incentive to join a second one.

This result differs from other models because they consider the incentive of two countries in a single regional agreement to go to free trade via multilateral tariff reduction or through expansion of the regional agreement. Since both of these affect each country's profits in *all* markets, the incumbent members of a bilateral free trade agreement will not have an incentive to achieve free trade if profits in the common market are reduced sufficiently. In contrast, entering a new bilateral agreement affects market access only in domestic market and in the new market, so the effect of the agreement on profits is smaller than it is for tariff reduction or BTA expansion. In the next section we show that this result is robust to an  $n$ -country model.

### 3 More than three countries

As the number of countries in the rest of the world increases, the beneficial effects of joining a bilateral agreement changes. In this section, we show that even if the number of countries is large, there is always an incentive for each country to form a bilateral agreement with all other countries. As noted above, when a country signs a BTA it gains consumer surplus at home and profits in the member's market, and it loses tariff revenue and domestic profits because the foreign firm has tariff-free market access. We show that the former two effects always dominate the latter two, provided each country signs on to numerous bilateral agreements.

In this section, we evaluate the welfare of a representative country  $j$ . Assume there are  $n$  countries,  $v$  bilateral agreements in the home country, the tariff level is  $t$ , and each foreign country  $i$  has  $w_i$  agreements. Using the price and profit function defined in equations (1) and (2), and total quantity  $Q = \sum q_j^i$ , we can solve for the quantity that the firm from country  $j$  exports to foreign country  $i$ . Assuming  $i$  and  $j$  do not have an agreement,  $j$  exports

$$q_j^i = \frac{(1 - c + (n - w - 2)t - nt)}{(n + 1)a},$$

where  $w$  is the number of foreign countries that have a BTA with  $i$ . The quantity that a firm from  $j$  produces for the domestic market is

$$q_j^j = \frac{(1 - c + (n - 1 - v)t)}{(n + 1)a},$$

where  $v$  is the number of bilateral agreements containing  $j$ . The quantity that the firm exports to a country that it has a free trade agreement with is the same as  $q_j^j$ , except that  $v$  is replaced with  $w$ . Using the export quantities we can solve for welfare. Welfare in country  $j$  is

$$\begin{aligned} W(v) = & \frac{(n(1 - c) - (n - 1 - v)t)^2}{2a(n + 1)^2} + \frac{(1 - c + (n - 1 - v)t)^2}{(n + 1)^2 a} + \sum_{i=1}^v \frac{(1 - c + (n - 1 - w_i)t)^2}{(n + 1)^2 a} \\ & + \sum_{i=v+1}^{n-1} \frac{(1 - c - (w_i + 2)t)^2}{(n + 1)^2 a} + (n - 1 - v)t \frac{(1 - c - (v + 2)t)}{(n + 1)a}. \end{aligned} \quad (7)$$

The first term is consumer surplus, the second term is domestic profits, the third term is profits in markets where the country has a bilateral agreement, the fourth term is profits in markets where the domestic country does not have a bilateral agreement, and the final term is tariff revenue. The number of agreements that contain  $j$ ,  $v$ , affects consumer surplus, domestic profits, and tariff revenue. As  $v$  increases, consumer surplus expands because a greater number of countries have duty-free access so competition is more intense. The competition effect also means that domestic profits fall. Tariff revenue falls because more countries have duty-free access and because countries that still face a tariff export less. The number of agreements in each foreign country,  $w_i$ , affects  $j$ 's profits in that country. As  $w_i$  increases,  $j$ 's profits abroad fall because a greater number of other countries have tariff-free access to foreign markets.

There are some restrictions on  $v$  and  $w_i$ . For example,  $v$  cannot equal one if each  $w_i$  is zero. That is, if  $j$  has a bilateral agreement with one country, then at least one other country must be a member of a bilateral agreement. In equilibrium this is not a problem, since by symmetry each country will choose to have the same number of agreements,  $w_i = w = v$ . Hence, with respect to country  $j$ , we can simplify the equation above as follows.

$$W(v) = \frac{(n(1-c) - (n-1-v)t)^2}{2a(n+1)^2} + \frac{(1-c + (n-1-v)t)^2}{(n+1)^2 a} + v \frac{(1-c + (n-1-w)t)^2}{(n+1)^2 a} \quad (8)$$

$$+ (n-1-v) \frac{(1-c - (w+2)t)^2}{(n+1)^2 a} + (n-1-v)t \frac{(1-c - (v+2)t)}{(n+1)a}.$$

The country's problem is to maximize welfare over the number of agreements, subject to the constraint that the number of agreements is between 0 and  $n-1$ , and taking the number of agreements that other countries have,  $w$ , as given, where  $w$  is also between 0 and  $n-1$ .

To solve the problem, we first examine how welfare changes with respect to a change in the number of agreements,  $v$ . The partial derivative of  $W$  with respect to  $v$  is

$$\frac{\partial W}{\partial v} = t \frac{(2n-1)(1-c) + t(2nv - 2w - 2nw + 5v + 3 - 3n)}{a(n+1)^2}. \quad (9)$$

The second derivative is :

$$\frac{\partial^2 W}{\partial v^2} = t \frac{t(2n+5)}{a(n+1)^2} > 0.$$

The welfare function is continuous and convex in  $v$ , which means that the critical point is a minimum, so the maximum must occur at one of the endpoints. As above and without loss of generality, we assume  $t$  is greater than zero and less than or equal to the prohibitive level ( $0 \leq t \leq \frac{1-c}{w+2}$ ). At the maximum value of  $v$ ,  $v = n - 1$ , the welfare function is increasing in  $v$ .

$$\frac{\partial W}{\partial v}(v = n - 1) = t \frac{(2n - 1)(1 - c) + 2t(n^2 - w - nw - 1)}{a(n + 1)^2} > 0,$$

for all feasible  $t$  and  $w$ . When  $v = 0$  the derivative can be positive or negative,

$$\frac{\partial W}{\partial v}(v = 0) = t \frac{(2n - 1)(1 - c) + t(-2w - 2nw + 3 - 3n)}{a(n + 1)^2} \leq 0,$$

depending on  $t$  and  $w$ . If  $t$  and  $w$  are large, the welfare function is decreasing in  $v$  at  $t = 0$ . This means that depending on the number of agreements other countries have,  $w$ , and the tariff level,  $t$ , the minimum value of the welfare function can lie within the restricted range for  $v$  or to the left of  $v$  ( $v < 0$ ). To find the maximum, we evaluate the welfare function at each endpoint. The solution is the corner solution,  $v = n - 1$  (see appendix for proof). In equilibrium, all countries have the same number of agreements and  $v = w = n - 1$ . Hence each country has bilateral agreements with all other countries.

Figures 1 and 2 illustrate how the number of bilateral agreements and how the tariff level affect the welfare level in one country. Figure 1 shows the welfare surface of country  $j$ , as the number of foreign bilateral agreements ( $w$ ) and domestic bilateral agreements ( $v$ ) change (assuming  $a = 1$ ,  $c = 0.1$ ,  $t = 0.01$  and  $n = 100$ ). For any given  $w$ , country  $j$  is always better off having agreements with all foreign countries. Welfare is greatest when  $j$  has agreements with all other countries and all other countries have no agreements with each other ( $w = 0$ ), though this is not an equilibrium.

Figure 2 shows the welfare surface for country  $j$  in equilibrium, over  $t$  and  $v$  (where all countries have the same number of agreements,  $v = w$ , and again assuming  $a = 1$ ,  $c = 0.1$ , and  $n = 100$ ). For any given tariff level,  $t$ , as the number of bilateral agreements increases welfare expands. Thus irrespective of the tariff level, a country is always better off signing agreements with all other countries.

Another point, which is evident from Figure 2, is that as the number of regional agreements multiplies, each country's welfare improves. In fact, the effect of expanding regionalism on welfare is very similar to the effect of a declining multilateral tariff. Provided countries act symmetrically, this will always be true. To see this, note that in equilibrium, when all countries have the same number of agreements ( $v = w$ ), equation 9, which shows how welfare changes with respect to a change in  $v$ , becomes

$$\frac{\partial W}{\partial v} = t \frac{(2n - 1)(1 - c) + 3t(v + 1 - n)}{a(n + 1)^2}.$$

Assuming the tariff is less than or equal to the prohibitive level,  $t \leq \frac{1-c}{v+2}$ , welfare is always increasing in the number of regional agreements ( $\frac{\partial W}{\partial v} > 0$ ).

In this section, we have shown that each country's strictly dominant strategy is to have a bilateral free trade agreement with all other countries. This implies that multilateral free trade will effectively be achieved through bilateral agreements. In addition, we have shown that welfare is monotonically increasing in the number of bilateral agreements that each country is a member of, assuming all countries act symmetrically.

## 4 Conclusion

This paper has shown that if the number of bilateral agreements is determined endogenously, free trade is the unique Nash equilibrium. If countries choose the number of agreements to join, the

strictly dominant strategy is to have a bilateral agreement with each other country. This implies that in equilibrium each country has a free trade agreement with every other country.

One interpretation of this result is that allowing for multiple bilateral agreements effectively unravels the optimal-tariff equilibrium. In the model without bilateral agreements, each country individually is better off maintaining a positive tariff, but in the resulting equilibrium all countries are worse off than they would be in free trade. In contrast, with bilateral agreements, each individual country is better off having a bilateral agreement with each other country, irrespective of what policy other countries follow. Regionalism is infectious, simply accounting for bilateral agreements allows countries to jump from an equilibrium with a positive tariff level to free trade.

While this paper has employed a simple oligopolistic model, the results are likely to carry over to other models as well. For example, in a model where terms-of-trade effects generate positive tariffs, engaging in numerous bilateral agreements is also likely to be welfare improving. The logic is that if a country joins a number of BTAs, demand for the home good increases by relatively more than the demand for foreign goods, implying that the relative price of the domestic good must increase. Demand for the home good increases by more because tariffs are eliminated in all foreign markets as a result of its BTAs, however the multiple agreements have little effect on world demand for the foreign goods since bilateral agreements only eliminate tariffs in the home market. Hence, all country pairs are likely to have free trade agreements in equilibrium.

## References

- [1] Baldwin, R., 1995. "A Domino Theory of Regionalism." In: Baldwin, R., Haaparanta P., Kiander J.(Eds.), *Expanding Membership of the European Union*. Cambridge University Press, Cambridge.
- [2] Bhagwati, J., 1993. "Regionalism and Multilateralism: An Overview." In: Panagariya A., De Melo J. (Eds.), *New Dimensions in Regional Integration*. Oxford University Press, Oxford.
- [3] Bhagwati, J., and A. Panagariya, 1996. "Preferential Trading Areas and Multilateralism: Strangers, Friends, or Foes?" In: Bhagwati J., Panagariya A. (Eds.), *The Economics of Preferential Trade Agreements*. AEI Press, Washington DC.
- [4] Bond, E. and C. Syropoulos, 1996 "The Size of Trading Blocs, Market Power and World Welfare Effects," *Journal of International Economics* 40:3-4, pp. 411-437.
- [5] Brander J., Krugman P., 1983. "A 'Reciprocal Dumping' Model of International Trade." *Journal of International Economics* 15, 313-323.
- [6] Brander J., Spencer B., 1984. "Tariff Protection and Imperfect Competition." In: H. Kierzkowski (Ed.), *Monopolistic Competition and International Trade*. Oxford University Press, Oxford.
- [7] Ethier, W., 1998. "Regionalism in a Multilateral World." *Journal of Political Economy* 106, 1214-1245.
- [8] Freund, C. 2000. "Multilateralism and the Endogenous Formation of Preferential Trade Agreements." forthcoming *Journal of International Economics*.
- [9] Grossman, G., Helpman E., 1995. "The Politics of Free Trade Agreements." *American Economic Review* 85, 667-690.

- [10] Kennan, J. and R. Riezman, 1990. "Optimal Tariff Equilibria with Customs Unions" *Canadian Journal of Economics* 23:1, 70-83
- [11] Krishna, P., 1998. "Regionalism and Multilateralism: A Political Economy Approach." *Quarterly Journal of Economics* 113, 227-251.
- [12] Levy, P., 1997. "A Political-Economic Analysis of Free-Trade Agreements." *American Economic Review* 87, 506-19.
- [13] Panagariya, A. 2000, "Preferential Trade Liberalization: The Traditional Theory and New Developments." *Journal of Economic Literature* Vol. 38, pp.287-331.
- [14] Panagariya, A. and R. Findlay 1996, "A Political Economy Analysis of Free Trade Areas and Customs Unions." Feenstra, R. Grossman, G., Irwin, D., Eds. *The Political Economy of Trade Policy: Papers in honor of Jagdish Bhagwati*. Cambridge and London: MIT Press, pages 265-87.
- [15] Yi, S., 1996. "Endogenous Formation of Customs Unions under Imperfect Competition: Open Regionalism is Good." *Journal of International Economics* 41, 153-177.

## 5 Appendix

This proof by contradiction shows that the value of welfare at  $v = n - 1$  is greater than at  $v = 0$ .

Welfare at  $v = 0$  is

$$W_b^x(v = 0) = \frac{(n(1-c) - (n-1)t)^2}{2a(n+1)^2} + \frac{(1-c + (n-1)t)^2}{(n+1)^2 a} + (n-1) \frac{(1-c - (w+2)t)^2}{(n+1)^2 a} + (n-1)t \frac{(1-c-2t)}{(n+1)a}. \quad (\text{A1})$$

Welfare at  $v = n - 1$  is

$$W_b^x(v = n - 1) = \frac{(n(1-c))^2}{2a(n+1)^2} + \frac{(1-c)^2}{(n+1)^2 a} + (n-1) \frac{(1-c + (n-1-w)t)^2}{(n+1)^2 a}.$$

The difference between the two is

$$W_b^x(v = n - 1) - W_b^x(v = 0) = \frac{1}{2}t \frac{(4n^2 - 6n + 2)(1-c) + t(n-1)(2n^2 + 1 - 3n - 4nw - 4w)}{a(n+1)^2}, \quad (\text{A2})$$

which is less than zero if the value at  $v = 0$  is greater than at  $v = n - 1$ . The first term in the numerator is positive, so it is negative only if the second term is negative and greater in absolute value than the first term. The second term is decreasing in  $t$ . The maximum value of  $t$  is  $t = \frac{1-c}{w+2}$ . Assuming the second term in the numerator is less than zero, and plugging in the maximum value of  $t$ , the following condition must hold if  $v = 0$  is the maximum:

$$N \geq (4n^2 - 6n + 2)(1-c) + \frac{1-c}{w+2} (n-1)(2n^2 + 1 - 3n - 4nw - 4w) = (1-c)(n-1) \frac{2n^2 + 5n - 6w - 3}{w+2}, \quad (\text{A3})$$

where  $N$  is the numerator of the expression on the right-hand side of equation A1. If  $N$  is less than zero then the expression on the right side of equation A3 must also be less than zero. This implies that  $w > \frac{(n+3)(2n-1)}{6}$ , but  $w$  must be less than  $n - 1$ ; a country can not have agreements with more countries than exist. Hence,  $v = n - 1$  is the maximum.

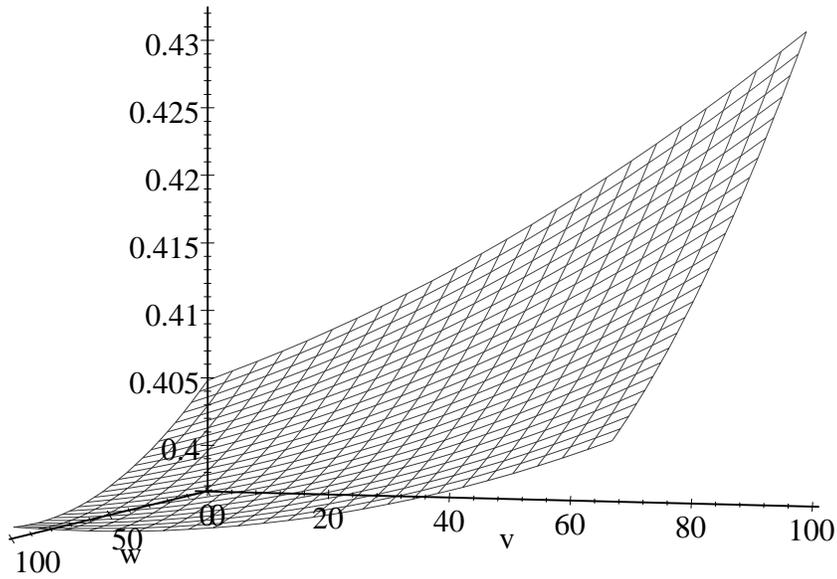


Figure 1: Domestic and Foreign Bilateral Agreements

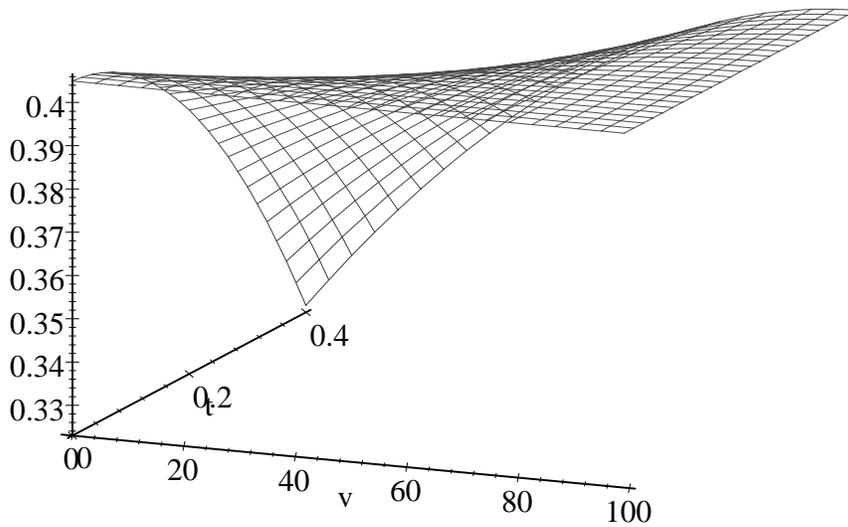


Figure 2: Bilateral Agreements, Tariffs, and Welfare