A Theory of Trade Disagreement

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Very preliminary - comments welcome

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Abstract

Global free trade, by definition, involves every country. Thus, in agreeing to this arrangement, every country must be made better off relative to all other agreements which are feasible. Through this lens of simple coalition formation, this causes significant problems, not only in reaching global free trade, but also in agreeing on *any* equilibrium at all. Specifically, using a simple model of intraindustry trade between countries and regions, I show that while some potential agreements can be discarded by all parties, there exists a large range of relevant parameter values such that countries cannot agree on a mutually beneficial trading arrangement based solely on market-access. This no-agreement outcome is more likely when cost differences between regions are high. When regional cost differences are low, global free-trade is the equilibrium outcome when trade costs are relatively low, and intraregional agreements are the outcome when trade costs are relatively high. These results highlight the important role of transfers and other instruments in facilitating a mutually beneficial trade agreement.

1 Introduction

The debate over the optimal way to liberalize trade has a long history in policy circles. In particular, the choice between a patchwork of regional agreements and larger multilateral agreements is the flash point for debate. However, despite the ongoing academic and policy discussions, and unlike stalled multilateral negotiations, the growth in regional agreements shows no signs of slowing. Figure 1 illustrates the growth in such agreements, where the number of regional agreements reported to the GATT/WTO has increased steadily over the last 50 years. Evidently, in Figure 1, Free Trade Agreements at the regional level appear to be the dominant choice of GATT/WTO member countries.[1]

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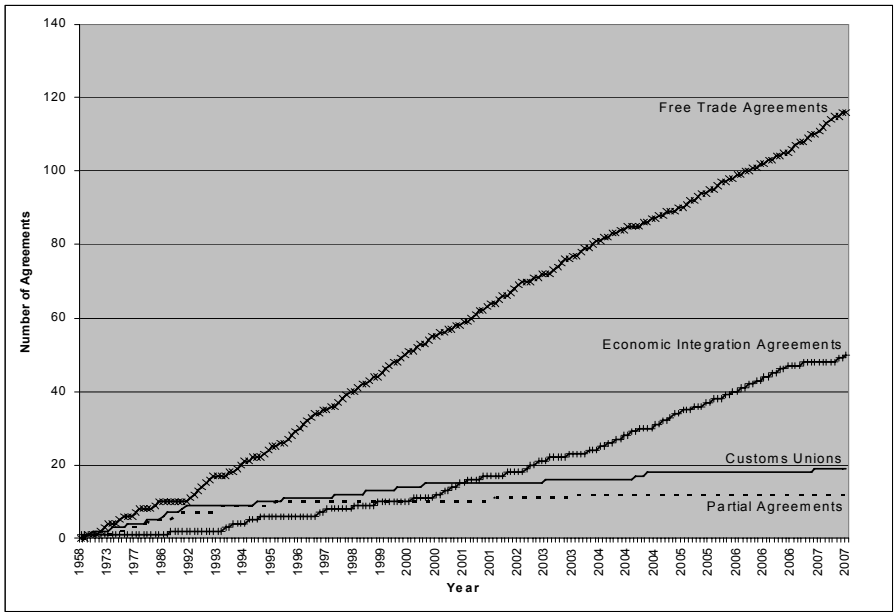
[1]The data used to produce this graph was obtained from the WTO website at http://www.wto.org/english/tratop_e/region_e/region_e.htm . Economic integration agreements include individual country accessions to current regional agreements. A number of caveats apply to this Figure, where the number of agreements do not take into account the size of the agreement or whether various types of agreements occur at the same time. For example, in the latter parts of the sample, Free Trade Agreements and Economic Integration Agreements often occur at the same time for the same countries.

Figure 1: Growth in Regional Trade Agreements



While there is little argument over the practical significance of these regional agreements, the welfare consequences are less certain. In the trade literature, the key question is whether regional agreements form "building blocks" for larger multilateral agreements, or serve as "stumbling blocks", creating opportunistic coalitions of countries who have no incentive for further cooperation with others outside of their own regional club (Bhagwati, 1990). Not surprisingly, there is no clear resolution to this question, where a variety of models have delivered informative, though conflicting results. The classic literature (Viner, 1950; Meade 1955) identifies trade creation and trade diversion as critical components of preferential agreements and their welfare effects. A preferential agreement could be welfare enhancing for all parties inside and outside of the agreement if trade from outsiders increases after the agreement is put in place. This is likely if the agreement reinforces traditional patterns of comparative advantage.

Aghion, Antras, and Helpman (2007) rigorously address this point within an extensive form model of negotiation, examining how externalities within preferential agreements dictate whether preferential agreements serve as "building blocks" or "stumbling blocks" in a move toward global free trade.[2] Specifically, they model how a lead country (the US, for example), chooses between negotiating regional agreements sequentially, or negotiating multilateral free trade all at once. Under certain conditions, especially when political pressures are significant, preferential agreements serve as stumbling blocks,

[2]Freund (2000), and Saggi (2006) are also recent papers addressing the building or stumbling block nature of preferential liberalization. The former shows in a repeated game framework that multilateral tariff reduction facilitates further preferential reductions. The latter, also using a repeated game format, shows that preferential agreements hinder multilateral cooperation when countries are symmetric. However, asymmetry can reverse this prediction.

and should be prohibited.[3] In other cases, global free trade will not occur without using preferential agreements as building blocks.

An alternate approach to Aghion, Antras, and Helpman (2007) is modeling the process as one of coalition formation. Coalition formation models, by design, not only examine the benefits of certain agreements, but weigh these agreements against other feasible options.[4] In these models, there is not an explicit extensive formulation of the game. Rather, given outcomes are identified as equilibria if no one nation or group of nations can profitably deviate to a more advantageous agreement. Saggi and Yildiz (2007) were the first to contribute in this area, where they derive non-cooperative coalition proof equilibria for a three country model. Under the assumption of symmetry, they show that Free Trade Agreements produce a weak stumbling block effect. In contrast, Free Trade Agreements can produce a strong building block effect when countries are asymmetric.

I adopt a similar approach as Saggi and Yildiz (2007), also using a model of coalition formation. However, in contrast with their work, I adopt a cooperative framework rather than non-cooperative. Both approaches are different from traditional political economy models, where the welfare effects of a specific agreement are analyzed, often ignoring whether one or both of the parties to the agreement may have a better option. The differences arise in how deviations occur. In my model, a given agreement outcome dominates another if, for all countries whose agreement status changes between the two, each country is made better off. This is different from Saggi and Yildiz (2007), where only the deviating party must be better off. Practically, the assumption of cooperative coalitions dictates that a binding agreement cannot be broken unless all parties agree to it. Thus, in contrast with Saggi and Yildiz, the cooperative framework will tend to admit more trading arrangements that are undominated, since it will naturally be harder to break agreements.

Further, and critically, I adopt a four-country setting, rather than a three-country setting. This causes additional problems in agreeing on *any* equilibrium at all. As detailed above, this is different from traditional political economy models, where if two countries decide whether to form an agreement, the third country is often left unable to adjust in any meaningful way. This is remedied by adding a fourth country, with whom the third country can join to balance the regional agreement between countries one and two. If the two trading-blocs prefer different equilibria, neither equilibria will be dominated, and a trade disagreement will occur. As it turns out, this disagreement will occur under fairly intuitive situations.

These points are illustrated using a simple two-region model of intraindustry trade in the style of Brander and Krugman (1983). Two regions are separated by a per-unit trade cost, where each region has two countries which border one another. One region is labeled as the "North" with marginal costs of production that are no lower than the other region, the "South". Each country in each region may set a specific MFN tariff, but may also agree to free trade with some coalition of other countries.

[3] A similar point is made by Krisna (1998) in a simple political economy model.

[4] Other similar papers in this literature are Burbridge, DePater, Myers, and Sengupta (1997), who address tax-policy coordination, showing that with many states, trading blocs form in equilibrium. Furusawa and Koneshi (2007) take a slightly different approach, modeling agreements as a network formation game. In their work, they show that unless countries are symmetric, a global free-trade outcome is not stable.

These coalitions are restricted to be one of four outcomes: (1) global free trade, (2) two intraregional agreements, (3) two extraregional "North-South" agreements, (4) no agreements.[5]

The results from this simple model are provocative. For a majority of the range of tariffs and regional cost differences such that trade occurs for all equilibrium arrangements, no one equilibrium outcome is dominant. That is, countries cannot agree on a unique equilibrium coalition. Indeed, there exists a value of trade cost such that disagreement is the only outcome.

Further, the no-agreement outcome is more likely when cost differences are high. When cost differences are low, global free-trade is optimal when trade costs are relatively low, and regional agreements are optimal when trade costs are relatively high. The intuition is that as cost-differences between regions increase, high-cost countries wish to cooperate within a regional agreement to act as a buffer from low-cost import competition. Of course, the incentive of low-cost countries is exactly the opposite, as they can gain substantially from unrestricted market access to countries with less-competitive firms. Eventually, as this cost-difference becomes large, this dichotomy becomes prohibitive, and there exist no parameter values such that agreement is possible.

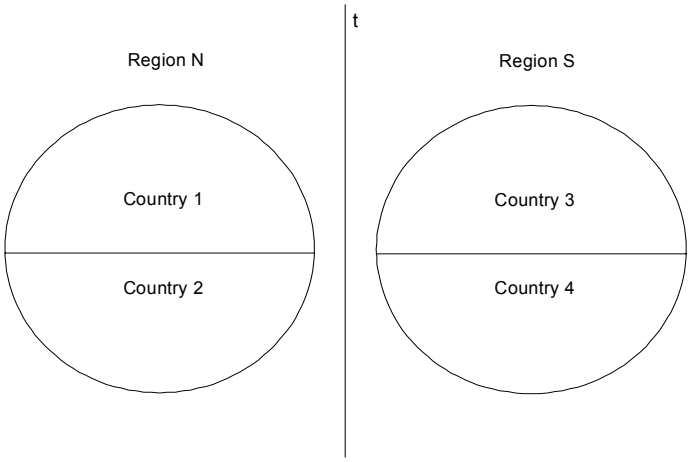
Despite the larger parameter space in which no agreement is possible, some equilibrium arrangements can be eliminated. That is, agreement can be reached that certain equilibrium outcomes are suboptimal for all parties. In particular, "no agreement" is always dominated in equilibrium by the intraregional agreement. Furthermore, unless cost differences are significant, "North-South" agreements will also be strictly opposed by all parties, where all countries prefer global free trade to "North-South" agreements. Thus, for a majority of the parameter space, the only equilibrium outcomes which remain undominated are global free trade and intraregional trade agreements.

Along with the aforementioned papers, this paper adds to the literature discussing "natural" and "unnatural" trading blocs. Frankel, Stein, and Wei (1995) and Wonnacott and Wonnacott (1981) have each argued trade costs play an important role in the formation of trade agreements. Panagariya (2000) disagrees, stating "trade costs are not special". In theoretical work, Panagariya (1998) justifies this statement by showing that trade costs have no bearing on the equilibrium outcome when comparative advantage dictates that you trade with your extraregional partners. Admittedly, their models are very different, and I make no effort to provide evidence for one or the other. Indeed, given the assumption of intraindustry trade, I find similar results to Frankel, Stein, and Wei (1995), where when cost differences are low, regional agreements are welfare improving for all parties when trade costs are relatively high. Further, I show that as cost-differences become large, which is closer to the flavor of Panagariya's argument, trade costs indeed make little difference. However, this is also precisely the region in which countries generally disagree, and trade costs have no influence on this feature either.

The paper is organized as follows. Section two presents the preliminaries of a stylized model. Sections three through five solve and apply this model to a variety of settings. Section three considers the case of cost symmetry between regions with positive trade costs. Section four considers the case

[5] Other asymmetric agreements have been analyzed, but add no further insight to the basic process of coalition formation. Thus, they are omitted to reduce clutter.

Figure 2: Model: Regions and Countries



of cost asymmetry between regions with no trade costs. Section five considers the general case of both cost asymmetry and positive trade costs. Section six discusses the stumbling block - building block debate, the role of transfers, and then briefly concludes.

2 Model Setup

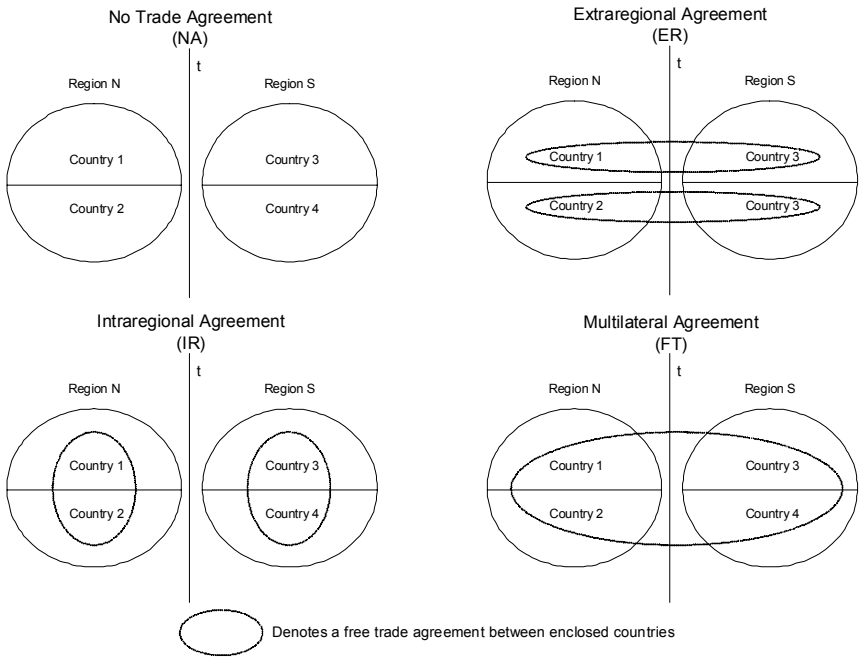
The setup of the model is kept simple in order to focus on the key fundamentals of trade agreements, and how countries may agree and disagree over which trading arrangements are the best option. The world consists of two regions, N and S, separated by a trade cost, t. The trade cost is per unit, and represents the costs of transportation. Within Region N, there are two countries, 1 and 2. Within Region S, there are also two countries, 3 and 4. These features are illustrated in Figure 2.

The timing of the model is also simple. There are three stages. In the first stage, countries discard trading arrangements that are mutually inefficient. The hope is that after this process is complete, there will be a unique trading arrangement which remains. In the second stage, subject to these agreements, countries set their external MFN tariffs. In the third and final stage, subject to agreements and tariff choices, firms make output decisions for each market. I introduce further specifics in reverse order.

The consumer-producer setup is very similar to Brander and Krugman (1983). Consumers in each country demand one aggregate good. Demand is assumed to take the form of $P = A - bQ$. The only difference between countries is the cost of production, where countries one and two incur a constant marginal cost of c, and countries three and four incur no cost of production. I assume that each country has only one producer.

In the tariff setting stage, each country is allowed to levy a common external tariff against imports

Figure 3: Possible Equilibrium Trade Agreements



from non-agreement countries. Tariffs against countries within an agreement are assumed to be zero. Countries maximize the sum of domestic profits, consumer surplus and tariff revenue when choosing their external tariff.

In the first stage, countries form binding trade agreements. Those which are mutually inefficient are discarded, or *dominated*. A given trading arrangement will be dominated if some other arrangement provides higher welfare to all decisive countries. A *decisive country* is one which experiences a change in preferential trading partners when comparing one agreement to the another. Assumptions of symmetry will guarantee that all countries are decisive countries. I assume that countries choose between four possible trading arrangements. These are illustrated in Figure 3.

In Figure 3, the circles represent a free trade agreement between the enclosed members. In the upper-left panel, there are no agreements (NA), and countries simply levy MFN tariffs. In the upper-right panel, each northern country forms an extraregional agreement (ER) with a low-cost southern country. Here, each country levies a common MFN tariff on one low and one high cost country. In the bottom-left panel, countries form intraregional agreements (IR), where MFN tariffs are levied against the opposing region. Finally, in the bottom-right panel, the world forms a multilateral free trade agreement, and no MFN tariffs are imposed.[6]

[6] Of course, there are a handful of asymmetric agreements which I could also consider. However, doing so actually yields no additional insight, as at least one type of country will prefer one of the aforementioned symmetric arrangements to an asymmetric arrangement in which they are the less-profitable party. Contact the author for results pertaining to alternate setups.

Introducing notation, $q_{i,j}$ represents production in country j sold in country i, and $\Pi_{i,j}$ represents profits earned by country j in country i. As mentioned above, let t be the per-unit transportation cost in shipping a good from region N to region S. Furthermore, let τ_i be the MFN tariff applied to all countries outside i. Finally, let $I_{i,j} = 1$ if there is a trade agreement between countries i and j, and 0 otherwise.

With this notation, without loss of generality, I will focus on production decisions for the markets in Countries 1 and 3. Countries 2 and 4 are identical to Countries 1 and 3, respectively, by the assumption symmetry. With this in mind, countries solve the following maximization problems in serving Country 1.

$$\begin{aligned}
\Pi_{1,1} &= \max_{q_{1,1}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - c) q_{1,1}\} \\
\Pi_{1,2} &= \max_{q_{1,2}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{1,2})\tau_1 - c) q_{1,2}\} \\
\Pi_{1,3} &= \max_{q_{1,3}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{1,3})\tau_1 - t) q_{1,3}\} \\
\Pi_{1,4} &= \max_{q_{1,4}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{1,4})\tau_1 - t) q_{1,4}\}
\end{aligned} \tag{1}$$

Likewise the maximization problems in serving Country 3 are:

$$\begin{aligned}
\Pi_{3,1} &= \max_{q_{3,1}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{3,1})\tau_3 - t - c) q_{1,1}\} \\
\Pi_{3,2} &= \max_{q_{3,2}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{3,2})\tau_3 - t - c) q_{1,2}\} \\
\Pi_{3,3} &= \max_{q_{3,3}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4})) q_{1,3}\} \\
\Pi_{3,4} &= \max_{q_{3,4}} \{(A - b(q_{1,1} + q_{1,2} + q_{1,3} + q_{1,4}) - (1 - I_{3,4})\tau_3) q_{1,4}\}
\end{aligned} \tag{2}$$

I will now solve each of these for each particular case outlined in Figure 3.

No Agreement (NA)

For this arrangement, $I_{i,j} = 0$ for all i and j. Quantities and profits in serving Country 1 are written as:

$$\begin{aligned}
\widehat{\Pi}_{1,1}^{NA} &= \frac{(A + 2t + 3\tau_1 - 3c)^2}{25b},\ \widehat{q}_{1,1}^{NA} = \frac{(A + 2t + 3\tau_1 - 3c)}{5b} \\
\widehat{\Pi}_{1,2}^{NA} &= \frac{(A + 2t - 2\tau_1 - 3c)^2}{25b},\ \widehat{q}_{1,2}^{NA} = \frac{(A + 2t - 2\tau_1 - 3c)}{5b} \\
\widehat{\Pi}_{1,3}^{NA} &= \frac{(A - 3t - 2\tau_1 + 2c)^2}{25b},\ \widehat{q}_{1,3}^{NA} = \frac{(A - 3t - 2\tau_1 + 2c)}{5b} \\
\widehat{\Pi}_{1,4}^{NA} &= \frac{(A - 3t - 2\tau_1 + 2c)^2}{25b},\ \widehat{q}_{1,4}^{NA} = \frac{(A - 3t - 2\tau_1 + 2c)}{5b}
\end{aligned}$$

The profits and quantities in serving Country 3 are written as:

$$\begin{aligned}
\widehat{\Pi}_{3,1}^{NA} &= \frac{(A-3t-2\tau_3-3c)^2}{25b},\ \widehat{q}_{3,1}^{NA} = \frac{(A-3t-2\tau_3-3c)}{5b} \\
\widehat{\Pi}_{3,2}^{NA} &= \frac{(A-3t-2\tau_3-3c)^2}{25b},\ \widehat{q}_{3,2}^{NA} = \frac{(A-3t-2\tau_3-3c)}{5b} \\
\widehat{\Pi}_{3,3}^{NA} &= \frac{(A+2t+3\tau_3+2c)^2}{25b},\ \widehat{q}_{3,3}^{NA} = \frac{(A+2t+3\tau_3+2c)}{5b} \\
\widehat{\Pi}_{3,4}^{NA} &= \frac{(A+2t-2\tau_3+2c)^2}{25b},\ \widehat{q}_{3,4}^{NA} = \frac{(A+2t-2\tau_3+2c)}{5b}
\end{aligned}$$

Naturally, trade barriers, whether they be physical or revenue collecting instruments, protect the import competing country. Physical trade barriers also protect the regional partner. However, before getting too far with the analysis, one must endogenously set tariffs to examine the true effect of trade costs, both directly through production decisions, and indirectly through the imposition of tariffs.

I assume no political pressures in setting the optimal tariff. Countries maximize the sum of consumer surplus, domestic profits, and tariff revenue. The Country 1 government solves the following maximization problem when setting their optimal tariff:

$$\begin{aligned}
W_1^{NA} &= \max_{\tau_1}\left\{CS_1^{NA}(\tau_1) + \widehat{\Pi}_{1,1}^{NA}(\tau_1) + \tau_1\left(\widehat{q}_{1,2}^{NA} + \widehat{q}_{1,3}^{NA} + \widehat{q}_{1,4}^{NA}\right)\right\} \\
&= \max_{\tau_1}\left\{\frac{(4A-2c-2t-3\tau_1)^2}{50b} + \frac{(A-3c+2t+3\tau_1)^2}{25b} + \frac{\tau_1(3A-4t-6\tau_1+c)}{5b}\right\}
\end{aligned}$$

The optimal tariff derived from the above maximization problem is:

$$\widehat{\tau}_1^{NA} = \frac{9A-2t-7c}{33}$$

Both higher trade costs t and higher northern costs c reduce the optimal tariff. Higher trade costs significantly reduce export supply from low cost suppliers, and thus higher tariffs would only exacerbate the consumption distortion. The effect of higher production costs in N is a little trickier. Higher production costs tend to increase export supply, which would, all else equal, tend to support a higher tariff. However, higher production costs imply that countries in N rely on countries in S in terms of consumer welfare. Also, the marginal benefit of protecting an inefficient domestic industry is quite low. In equilibrium, higher production costs in the north tend to decrease optimal MFN tariffs applied by the north.

Substituting $\widehat{\tau}_1^{NA}$ into W_1^{NA}, equilibrium welfare is written as:

$$\widehat{W}_1^{NA} = \frac{945A^2 - 684At - 2046Ac + 2364t^2 + 1276tc + 3045c^2}{2178b} \tag{3}$$

This expression will simplify considerably in the following sections. Of course, by symmetry, $\widehat{\tau}_1^{NA} = \widehat{\tau}_2^{NA}$ and $\widehat{W}_1^{NA} = \widehat{W}_2^{NA} \equiv \widehat{W}_N^{NA}$

Moving on to the tariff chosen by countries in the south, welfare is written as:

$$\begin{aligned} W_3^{NA} &= \max_{\tau_3}\left\{CS_3^{NA}(\tau_3)+\widehat{\Pi}_{3,3}^{NA}(\tau_3)+\tau_3\left(\widehat{q}_{3,1}^{NA}+\widehat{q}_{3,2}^{NA}+\widehat{q}_{3,4}^{NA}\right)\right\} \\ &= \max_{\tau_3}\left\{\frac{(4A-2c-2t-3\tau_3)^2}{50b}+\frac{(A+2c+2t+3\tau_3)^2}{25b}+\frac{\tau_3(3A-4t-6\tau_3-4c)}{5b}\right\} \end{aligned}$$

The optimal $\widehat{\tau}_3$ tariff is:

$$\widehat{\tau}_3^{NA}=\frac{9A-2t-2c}{33}$$

Note that $\widehat{\tau}_3^{NA}$ is larger than $\widehat{\tau}_1^{NA}$ for positive c. The intuition is that the consumption distortion is lower for these countries, as firms in S are better suited than firms in N to offset the consumption distortion from a higher tariff. Thus, S countries levy a higher tariff.

Substituting $\widehat{\tau}_3$ into W_3^{NA}, equilibrium welfare is written as:

$$\widehat{W}_3^{NA}=\frac{945A^2-684At+156Ac+2364t^2-592tc+1944c^2}{2178b} \tag{4}$$

As with $\widehat{W}_S^{NA}$, we have by symmetry that $\widehat{W}_3^{NA}=\widehat{W}_4^{NA}\equiv\widehat{W}_S^{NA}$.

Prohibitive trade cost - marginal cost combinations

By construction, the NA structure will be the most competitive, and thus will generally require the most restrictive set of parameter values such that all countries trade with one another. I now derive the region of parameters such that this is the case. First, substituting $\widehat{\tau}_1^{NA}$ and $\widehat{\tau}_3^{NA}$ into $\widehat{q}_{i,j}^{NA\prime}s$, I get:

$$\begin{aligned} \widehat{q}_{1,1}^{NA} &= \frac{12(A+t-2c)}{33b},\ \widehat{q}_{1,2}^{NA}=\frac{3A+14t-17c}{33b},\ \widehat{q}_{1,3}^{NA}=\frac{3A-19t+16c}{33b},\ \widehat{q}_{1,4}^{NA}=\frac{3A-19t+16c}{33b} \\ \widehat{q}_{3,1}^{NA} &= \frac{3A-19t-19c}{33b},\ \widehat{q}_{3,2}^{NA}=\frac{3A-19t-19c}{33b},\ \widehat{q}_{3,3}^{NA}=\frac{12(A+t+c)}{33b},\ \widehat{q}_{3,4}^{NA}=\frac{3A+14t+14c}{33b} \end{aligned}$$

Not surprisingly $\widehat{q}_{3,1}^{NA}$ and $\widehat{q}_{3,2}^{NA}$ are the lowest production levels at any given pair of c and t. They are the highest cost suppliers, and incur the transportation cost t. Thus, I adopt the following restriction on parameter values to ensure that bilateral trade remains positive between all countries:

$$3A-19t-19c>0 \tag{5}$$

This condition will be used to identify whether points of indifference between trading arrangements occur within the set of parameters in which trade occurs between all countries.

Intraregional Agreement (IR)

For this arrangement, each country enters an enforceable free trade agreement with the other country in its own region. In (1) and (2), this implies the following assignments of $I_{i,j}$:

$$I_{1,2} = I_{2,1} = I_{4,3} = I_{3,4} = 1$$

All other $I_{i,j} = 0$. Quantities and profits in serving country one are written as:

$$\begin{aligned}
\widehat{\Pi}_{1,1}^{IR} &= \frac{(A+2t+2\tau_1-3c)^2}{25b},\ \widehat{q}_{1,1}^{IR} = \frac{(A+2t+2\tau_1-3c)}{5b} \\
\widehat{\Pi}_{1,2}^{IR} &= \frac{(A+2t+2\tau_1-3c)^2}{25b},\ \widehat{q}_{1,2}^{IR} = \frac{(A+2t+2\tau_1-3c)}{5b} \\
\widehat{\Pi}_{1,3}^{IR} &= \frac{(A-3t-3\tau_1+2c)^2}{25b},\ \widehat{q}_{1,3}^{IR} = \frac{(A-3t-3\tau_1+2c)}{5b} \\
\widehat{\Pi}_{1,4}^{IR} &= \frac{(A-3t-3\tau_1+2c)^2}{25b},\ \widehat{q}_{1,4}^{IR} = \frac{(A-3t-3\tau_1+2c)}{5b}
\end{aligned}$$

The profits and quantities in serving country 3 are written as:

$$\begin{aligned}
\widehat{\Pi}_{3,1}^{IR} &= \frac{(A-3\tau_3-3t-3c)^2}{25b},\ \widehat{q}_{3,1}^{IR} = \frac{(A-3\tau_3-3t-3c)}{5b} \\
\widehat{\Pi}_{3,2}^{IR} &= \frac{(A-3\tau_3-3t-3c)^2}{25b},\ \widehat{q}_{3,2}^{IR} = \frac{(A-3\tau_3-3t-3c)}{5b} \\
\widehat{\Pi}_{3,3}^{IR} &= \frac{(A+2\tau_3+2t+2c)^2}{25b},\ \widehat{q}_{3,3}^{IR} = \frac{(A+2\tau_3+2t+2c)}{5b} \\
\widehat{\Pi}_{3,4}^{IR} &= \frac{(A+2\tau_3+2t+2c)^2}{25b},\ \widehat{q}_{3,4}^{IR} = \frac{(A+2\tau_3+2t+2c)}{5b}
\end{aligned}$$

As before, country one solves the following maximization problem when setting their optimal tariff:

$$\begin{aligned}
W_1^{IR} &= \max_{\tau_1}\left\{CS_1^{IR}(\tau_1) + \widehat{\Pi}_{1,1}^{IR}(\tau_1) + \tau_1\left(\widehat{q}_{1,3}^{IR} + \widehat{q}_{1,4}^{IR}\right)\right\} \\
&= \max_{\tau_1}\left\{\frac{(4A-2t-2\tau_1-2c)^2}{50b} + \frac{(A+2t+2\tau_1-3c)^2}{25b} + \frac{\tau_1(2A-6t-6\tau_1+4c)}{5b}\right\}
\end{aligned}$$

The optimal tariff derived from the above maximization problem is:

$$\widehat{\tau}_1^{IR} = \frac{A-3t+2c}{8}$$

Here, the effect of trade costs is similar to $\widehat{\tau}_1^{NA}$. However, the effect of production costs in N is not. Precisely, all dutiable imports now come from low-cost countries, and an increase in cost asymmetry between countries will cause a surge of imports to N. While this causes a similar consumption distortion to W_1^{NA}, the ability to collect revenue through positive tariffs is now larger. In equilibrium, this yields an optimal tariff which is increasing in the northern production cost.

Substituting $\widehat{\tau}_1^{IR}$into W_1^{IR}, equilibrium welfare is written as:

$$\widehat{W}_1^{IR} = \frac{15A^2 - 10At - 30Ac + 23t^2 - 6tc + 33c^2}{32b} \tag{6}$$

Again, by symmetry, $\widehat{\tau}_1^{IR} = \widehat{\tau}_2^{IR}$ and $\widehat{W}_1^{IR} = \widehat{W}_2^{IR} \equiv \widehat{W}_N^{IR}$

Moving on to the tariff chosen by countries in the south, welfare is written as:

$$\begin{aligned} W_3^{IR} &= \max_{\tau_3} \left\{ CS_3^{IR}(\tau_3) + \widehat{\Pi}_{3,3}^{IR}(\tau_3) + \tau_3 \left(\widehat{q}_{3,1}^{IR} + \widehat{q}_{3,2}^{IR} \right) \right\} \\ &= \max_{\tau_3} \left\{ \frac{(4A - 2\tau_3 - 2t - 2c)^2}{50b} + \frac{(A + 2\tau_3 + 2t + 2c)^2}{25b} + \frac{\tau_3(2A - 6\tau_3 - 6t - 6c)}{5b} \right\} \end{aligned}$$

The optimal $\widehat{\tau}_3$ tariff is:

$$\widehat{\tau}_3^{IR} = \frac{A - 3t - 3c}{8}$$

Here, note that $\widehat{\tau}_3^{IR}$ is smaller than $\widehat{\tau}_1^{IR}$ for positive c. The intuition is that as the cost difference c increases, export supply decreases, which decreases the incentive of countries in S to collect tariff revenue.

Substituting $\widehat{\tau}_3$ into W_3^{IR}, equilibrium welfare is written as:

$$\widehat{W}_S^{IR} \equiv \widehat{W}_4^{IR} = \widehat{W}_3^{IR} = \frac{15A^2 - 10At + 23t^2 + 16tc + 18c^2}{32b} \tag{7}$$

Extraregional Agreement (ER)

For this arrangement, each country enters an enforceable free trade agreement with a country in the opposing region. Assuming without loss of generality that 1 joins with 3 and 2 joins with 4, this implies the following assignments of $I_{i,j}$:

$$I_{1,3} = I_{3,1} = I_{4,2} = I_{2,4} = 1$$

All other $I_{i,j} = 0$. Quantities and profits in serving Country 1 are written as:

$$\begin{aligned} \widehat{\Pi}_{1,1}^{ER} &= \frac{(A + 2t + 2\tau_1 - 3c)^2}{25b},\ \widehat{q}_{1,1}^{ER} = \frac{(A + 2t + 2\tau_1 - 3c)}{5b} \\ \widehat{\Pi}_{1,2}^{ER} &= \frac{(A + 2t - 3\tau_1 - 3c)^2}{25b},\ \widehat{q}_{1,2}^{ER} = \frac{(A + 2t - 3\tau_1 - 3c)}{5b} \\ \widehat{\Pi}_{1,3}^{ER} &= \frac{(A - 3t + 2\tau_1 + 2c)^2}{25b},\ \widehat{q}_{1,3}^{ER} = \frac{(A - 3t + 2\tau_1 + 2c)}{5b} \\ \widehat{\Pi}_{1,4}^{ER} &= \frac{(A - 3t - 3\tau_1 + 2c)^2}{25b},\ \widehat{q}_{1,4}^{ER} = \frac{(A - 3t - 3\tau_1 + 2c)}{5b} \end{aligned}$$

Profits and quantities in serving Country 3 are written as:

$$\begin{aligned}
\widehat{\Pi}_{3,1}^{ER} &= \frac{(A+2\tau_3-3t-3c)^2}{25b},\ \widehat{q}_{3,1}^{ER} = \frac{(A+2\tau_3-3t-3c)}{5b} \\
\widehat{\Pi}_{3,2}^{ER} &= \frac{(A-3\tau_3-3t-3c)^2}{25b},\ \widehat{q}_{3,2}^{ER} = \frac{(A-3\tau_3-3t-3c)}{5b} \\
\widehat{\Pi}_{3,3}^{ER} &= \frac{(A+2\tau_3+2t+2c)^2}{25b},\ \widehat{q}_{3,3}^{ER} = \frac{(A+2\tau_3+2t+2c)}{5b} \\
\widehat{\Pi}_{3,4}^{ER} &= \frac{(A-3\tau_3+2t+2c)^2}{25b},\ \widehat{q}_{3,4}^{ER} = \frac{(A-3\tau_3+2t+2c)}{5b}
\end{aligned}$$

As before, country one solves the following maximization problem when setting their optimal tariff:

$$\begin{aligned}
W_1^{ER} &= \max_{\tau_1}\left\{CS_1^{ER}(\tau_1)+\widehat{\Pi}_{1,1}^{ER}(\tau_1)+\tau_1\left(\widehat{q}_{1,2}^{ER}+\widehat{q}_{1,4}^{ER}\right)\right\} \\
&= \max_{\tau_1}\left\{\frac{(4A-2t-2\tau_1-2c)^2}{50b}+\frac{(A+2t+2\tau_1-3c)^2}{25b}+\frac{\tau_1(2A-6\tau_1-t-c)}{5b}\right\}
\end{aligned}$$

The optimal tariff derived from the above maximization problem is:

$$\widehat{\tau}_1^{ER} = \frac{6A+7t-13c}{48}$$

Across the board, a higher value of c decreases the value of protection. In contrast, trade costs evidently increase the value of protection through a more profitable domestic sector.

Substituting $\widehat{\tau}_1^{ER}$ into W_1^{ER}, equilibrium welfare is written as:

$$\widehat{W}_1^{ER} = \frac{540A^2-564At+1295t^2-1356Ac+994tc+1691c^2}{1152b} \tag{8}$$

This expression will also simplify considerably in the following sections. Of course, by symmetry, $\widehat{\tau}_1^{ER}=\widehat{\tau}_2^{ER}$ and $\widehat{W}_1^{ER}=\widehat{W}_2^{ER}\equiv\widehat{W}_N^{ER}$.

Moving on to the tariff chosen by countries in the south, welfare is written as:

$$\begin{aligned}
W_3^{IR} &= \max_{\tau_3}\left\{CS_3^{ER}(\tau_3)+\widehat{\Pi}_{3,3}^{ER}(\tau_3)+\tau_3\left(\widehat{q}_{3,2}^{IR}+\widehat{q}_{3,4}^{IR}\right)\right\} \\
&= \max_{\tau_3}\left\{\frac{(4A-2t-2\tau_3-2c)^2}{50b}+\frac{(A+2\tau_3+2t+2c)^2}{25b}+\frac{\tau_3(2A-6\tau_3-t-c)}{5b}\right\}
\end{aligned}$$

The optimal $\widehat{\tau}_3$ tariff is:

$$\widehat{\tau}_3^{ER} = \frac{6A+7t+7c}{48}$$

Unlike $\widehat{\tau}_1^{ER}$, $\widehat{\tau}_3^{ER}$ is increasing in the northern cost c. As c becomes large, this increases the value of protecting the domestic industry, different from countries in N.

Substituting $\widehat{\tau}_3^{ER}$ into W_3^{ER}, equilibrium welfare is written as:

$$\widehat{W}_S^{ER} \equiv \widehat{W}_3^{ER} = \widehat{W}_4^{ER} = \frac{540A^2 - 564At + 1295t^2 + 276Ac - 430tc + 875c^2}{1152b} \tag{9}$$

Multilateral Free Trade (FT)

For this arrangement, every country agrees to free trade with all countries. Thus, $I_{i,j} = 1$ for all i and j. Quantities and profits in serving Country 1 are written as:

$$\begin{aligned}
\widehat{\Pi}_{1,1}^{FT} &= \frac{(A+2t-3c)^2}{25b},\ \widehat{q}_{1,1}^{FT} = \frac{(A+2t-3c)}{5b} \\
\widehat{\Pi}_{1,2}^{FT} &= \frac{(A+2t-3c)^2}{25b},\ \widehat{q}_{1,2}^{FT} = \frac{(A+2t-3c)}{5b} \\
\widehat{\Pi}_{1,3}^{FT} &= \frac{(A-3t+2c)^2}{25b},\ \widehat{q}_{1,3}^{FT} = \frac{(A-3t+2c)}{5b} \\
\widehat{\Pi}_{1,4}^{FT} &= \frac{(A-3t+2c)^2}{25b},\ \widehat{q}_{1,4}^{FT} = \frac{(A-3t+2c)}{5b}
\end{aligned}$$

Profits and quantities in serving Country 3 are written as:

$$\begin{aligned}
\widehat{\Pi}_{3,1}^{FT} &= \frac{(A-3t-3c)^2}{25b},\ \widehat{q}_{3,1}^{FT} = \frac{(A-3t-3c)}{5b} \\
\widehat{\Pi}_{3,2}^{FT} &= \frac{(A-3t-3c)^2}{25b},\ \widehat{q}_{3,2}^{FT} = \frac{(A-3t-3c)}{5b} \\
\widehat{\Pi}_{3,3}^{FT} &= \frac{(A+2t+2c)^2}{25b},\ \widehat{q}_{3,3}^{FT} = \frac{(A+2t+2c)}{5b} \\
\widehat{\Pi}_{3,4}^{FT} &= \frac{(A+2t+2c)^2}{25b},\ \widehat{q}_{3,4}^{FT} = \frac{(A+2t+2c)}{5b}
\end{aligned}$$

Without a need to calculate an optimal tariff, equilibrium welfare is written as:

$$\widehat{W}_N^{FT} \equiv \widehat{W}_1^{FT} = \widehat{W}_2^{FT} = \frac{2\left(6A^2 - 6At + 14t^2 - 16Ac + 8tc + 19c^2\right)}{25b} \tag{10}$$

Similarly, $\widehat{W}_3^{FT}$ is written as:

$$\widehat{W}_S^{FT} \equiv \widehat{W}_3^{FT} = \widehat{W}_4^{FT} = \frac{2\left(6A^2 - 6At + 14t^2 + 4Ac - 2tc + 9c^2\right)}{25b} \tag{11}$$

With the welfare functions derived, I can now roll back to stage 1 and derive which agreements may be mutually beneficial for countries in the North and South. I will first present results for the polar case of no cost differences between regions. Then, I will eliminate trade costs while addressing the case of asymmetric production costs. Finally, I will present results allowing for positive transportation costs and cost asymmetry between regions.

3 Equilibrium: Cost symmetry with costly trade

In this section, I will solve and discuss the model with no cost-differences between countries. For simplicity, I assume that the costs of production in each country are zero. Thus, the only costs which affect the distribution of production and consumption are the physical trade barriers and levied MFN tariffs. Finally, since there are no cost differences, and each trading arrangement is symmetric, welfare functions for all countries will be identical. Thus, it suffices to inspect one in assigning preference relationships to the four possible structures of trade agreements.

To begin, worldwide free trade, FT, will be compared with no agreement, NA. Comparing the welfare functions in (3) and (10), countries prefer free trade to no agreement if:

$$\widehat{W}_N^{FT} - \widehat{W}_N^{NA} = \widehat{W}_S^{FT} - \widehat{W}_S^{NA} = \frac{837A^2 - 3012At + 628t^2}{18150b} > 0$$

Clearly, at $t = 0$, countries prefer FT to NA. For larger values of t, note that $837A^2 - 3012At + 628t^2 = 0$ if $t = \{\frac{93}{314}A, \frac{9}{2}A\}$. Using (5), the values must satisfy $t < \frac{3}{19}A$, which they do not. Thus, countries always prefer FT to NA.

Next, using (8) and (10), FT is preferred to ER if:

$$\widehat{W}_N^{FT} - \widehat{W}_N^{ER} = \widehat{W}_S^{ER} - \widehat{W}_S^{ER} = \frac{(6A + 7t)(54A - 17t)}{28800b} > 0$$

This will clearly be satisfied for $t < \frac{3}{19}A \left(< \frac{54}{17}A\right)$.

Finally, using (6) and (10), FT is preferred to IR if:

$$\widehat{W}_N^{FT} - \widehat{W}_N^{IR} = \widehat{W}_S^{FT} - \widehat{W}_S^{IR} = \frac{(A - 3t)(9A - 107t)}{800b} > 0$$

This is positive if $t < \frac{9}{107}A$, which is clearly within the region specified by $t < \frac{3}{19}A$. The other zero, $t = \frac{1}{3}$, is not. Thus, FT is preferred to the intraregional agreement if $t < \frac{9}{107}A$, or trade costs are sufficiently low.

The full results of this section are summarized in the following Proposition.

Proposition 1 *Over the non-prohibitive region of trade costs, NA and ER are always dominated. Further, if $t \in \left(0, \frac{9}{107}A\right)$, free trade ($FT$) is preferred to an intraregional agreement (IR). For $t \in \left(\frac{9}{107}A, \frac{3}{19}A\right)$, IR is preferred to FT.*

The result in Proposition 1 is very similar to a result in Frankel, Stein and Wei (1995). The intuition is explained as follows. Generally, in models of coalition formation, it is ideal to form a coalition with the strongest competitor(s). When trade costs are high, the strongest competitor for each country is its regional partner. In forming regional coalitions, countries trade significant market access while still collecting some tariff revenue. This more than compensates for a small consumer loss when compared with an outcome of free trade. Since countries outside of the agreements are distant, the amount of diverted trade from these partners is minimal.

On the other hand, when trade costs are low, countries compete on an relatively even playing field. Thus, the trade diversion associated with a regional agreement is significant, and in a symmetric equilibrium, all countries are worse off under a regional agreement. Thus, countries choose instead to form a coalition with all countries; global free trade.

Of course, this logic fails to account for any cost-asymmetry between countries. If regions are asymmetric in terms of productivity, high and low cost regions may prefer different agreements. I now turn to addressing precisely this issue.

4 Equilibrium: Costless trade with cost asymmetry

Unlike the last section, this section will dispense with the assumption of costly trade between regions, only focusing on the effects of cost asymmetry on the equilibrium trading arrangement. Since regions are now asymmetric, welfare functions of countries in both regions must be analyzed to determine which equilibrium outcomes are dominated or undominated. Precisely, I adopt the definition that a equilibrium trading arrangement is dominated if both N and S countries agree that a different arrangement yields higher welfare for both parties.

As before, I will first show that the arrangement with no trade agreements will never occur in equilibrium. To do this, I will show that IR dominates NA for all relevant values of c. Precisely, IR is preferred to NA for countries in N if:

$$\widehat{W}_N^{IR} - \widehat{W}_N^{NA} = \frac{1215A^2 + 66Ac - 12783c^2}{34848b} > 0$$

By using the quadratic formula, the LHS is greater than zero if $c \in (-0.30573A, 0.31089A)$. The relevant range of parameter values, $c \in \left(0, \frac{3}{19}A\right)$ from (5), satisfies this condition. Region S countries prefer IR to NA if the following condition holds:

$$\widehat{W}_S^{IR} - \widehat{W}_S^{NA} = \frac{1215A^2 - 2496Ac - 11502c^2}{54450b} > 0$$

By using the quadratic formula, the LHS is greater than zero if $c \in (-0.45115A, 0.23414A)$. The relevant range of parameter values also satisfies this condition. Thus, we have the following lemma:

Lemma 1 *For $t = 0$, over the region $c \in \left(0, \frac{3}{19}A\right)$, IR dominates NA.*

In Lemma 1, intraregional agreements partially solve the prisoner's dilemma that occurs when there is no cooperation among countries. While there is still opportunistic behavior at the regional level, the increased regional market access along with continued tariff revenue dominates the low market access of NA.

Next, I turn to the region such that ER is dominated. I will start with IR as a comparison.

Precisely, IR is preferred to ER for countries in N if:

$$\widehat{W}_N^{IR} - \widehat{W}_N^{ER} = \frac{(276A - 503c)\, c}{1152b} > 0$$

This is clearly satisfied for $c \in \left(0, \frac{3}{19}A\right)$. For firms in S, IR is preferred to ER if:

$$\widehat{W}_S^{IR} - \widehat{W}_S^{ER} = \frac{-(227c + 276A)\, c}{1152b} > 0$$

This will clearly not be satisfied. Thus, there is no dominance relationship between IR and ER.

Next, I compare FT and ER, where FT is preferred to ER for countries in N if:

$$\widehat{W}_N^{FT} - \widehat{W}_N^{ER} = \frac{324A^2 - 2964Ac + 1501c^2}{28800b} > 0$$

The RHS is greater than zero if $c < 0.11614A$ or $c > 1.85854A$. The first condition is only relevant, and is within the range $c \in \left(0, \frac{3}{19}A\right)$. For countries in S, FT is preferred to ER if:

$$\widehat{W}_S^{FT} - \widehat{W}_S^{ER} = \frac{324A^2 - 2964Ac + 1501c^2}{28800b} > 0$$

The RHS is greater than zero if $c \in (-0.1314A, 2.1648A)$. This is clearly within $c \in \left(0, \frac{3}{19}A\right)$. Thus we have the following lemma:

Lemma 2 *For $t = 0$, over the region $c \in (0, 0.11614A)$, FT dominates ER. For $c \in \left(0.11614A, \frac{3}{19}A\right)$, ER remains undominated.*

In Lemma 2, at low levels of cost asymmetry between regions, countries are equally competitive with one another. Thus, they prefer to form a coalition with all other countries. When cost asymmetries are high, countries in N prefer to form coalitions with *one* low cost partner. Forming a coalition with *both* low-cost countries would undermine the competitiveness of their import competing firms. However, under the same conditions, low-cost countries will not agree to this arrangement, as they are strictly better off with unrestricted market access to countries with less competitive firms.

Next, I turn attention to the region of c such that IR is dominated or undominated. From above, we have established that there is no dominance relationship between IR and ER. Thus, we must examine when FT dominates IR. For countries in N, FT is preferred to IR if:

$$\widehat{W}_N^{FT} - \widehat{W}_N^{IR} = \frac{9A^2 - 274Ac + 391c^2}{800b} > 0$$

The RHS is greater than zero if $c < 0.03455A$ or $c > 0.66622A$. The first condition is clearly in the region of relevant c. For countries in S, FT is preferred to IR if:

$$\widehat{W}_S^{FT} - \widehat{W}_S^{IR} = \frac{9A^2 + 256Ac + 126c^2}{800b} > 0$$

This is always satisfied. The dominance relationships for FT and IR are summarized in the following lemma.

Lemma 3 *For $t = 0$, over the region $c \in (0, 0.03455A)$, FT dominates IR. For $c \in \left(0.03455A, \frac{3}{19}A\right)$, FT and IR remain undominated.*

The intuition here is similar to Lemma 2. Low-cost countries always want unrestricted access to markets occupied by high-cost firms, and thus always prefer FT to IR. High cost countries would like to do something to offset the competitive advantage of low-cost countries. Thus, when cost asymmetries are high, high costs countries prefer forming a coalition with their regional partner to provide a buffer against low-cost import competition. Within this region, no agreement can be reached.

The result of Lemmas 1 through 3 can be compiled and summarized in the following proposition.

Proposition 2 *For $t = 0$, the equilibrium of the model is summarized as follows:*

For	$c \in (0, 0.03455A)$	*FT remains undominated*
	$c \in (0.03455A, 0.11614A)$	*FT and IR remain undominated*
	$c \in \left(0.11614A, \frac{3}{19}A\right)$	*FT, IR and ER remain undominated*

The results here follow a similar trend. Countries will form a given trade agreement if all parties are better off relative to all other options. In the case of no trade costs, the critical feature is the cost advantage of southern countries. If this cost advantage is low, then all countries agree that the benefits of market access through free trade offset any loss in market power or tariff revenue. However, if the southern cost advantage is high, then northern firms wish to limit the amount of market access afforded to southern firms. This causes a disagreement regarding which trading arrangement is best, as southern firms still desire full unrestricted market access to northern markets.

5 Equilibrium: Cost asymmetry and costly trade

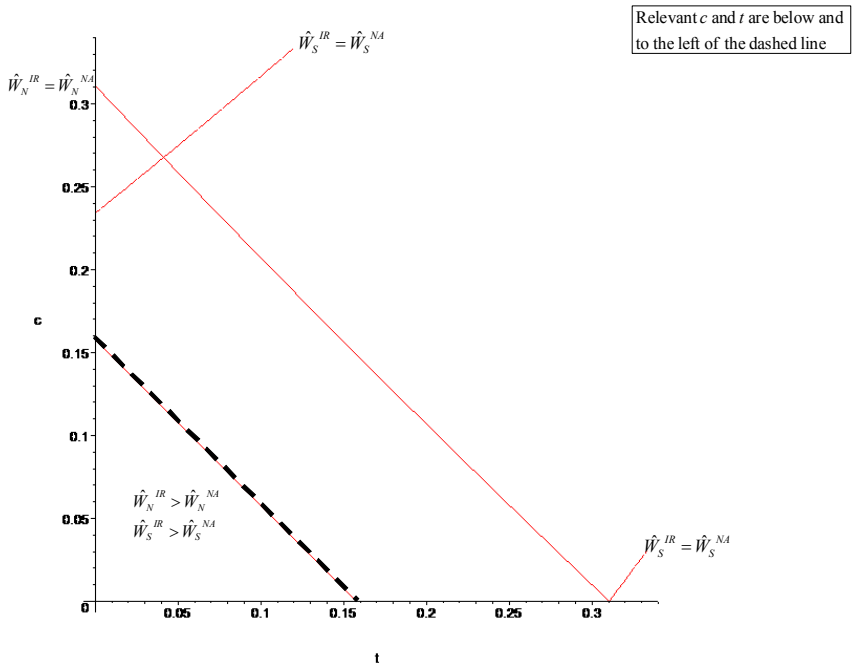
In this section, I allow for both asymmetric costs and trade costs between regions to analyze how both types of asymmetry jointly effect the equilibrium set of trading arrangements. To clearly analyze the problem in two dimensions, I henceforth adopt the following restriction on parameters:

$$\begin{aligned} A &= 1 \\ b &= 1 \end{aligned}$$

This will allow for an examination indifference conditions using a readily available package, *implicitplot*, in the software package *Maple.*

To begin, Figure 4 establishes the dominance relationship between NA and IR. In Figure 4, the dashed line represents the largest values of c and t such that bilateral trade between all countries

Figure 4: No Agreement (NA) dominated by an Intraregional Agreement (IR)



occurs. Thus, the relevant range of parameters is below this dashed line and to the left. The other lines in Figure 4 represent indifference points between IR and NA for countries in N and S. Clearly, these loci of indifference are outside of the relevant range of parameters such that trade occurs. Given the result in Lemma 1, this implies that NA is dominated by IR for all relevant values of t and c.[7]

Moving forward, and henceforth excluding NA, I will focus on the preference conditions for Northern countries. These preference conditions are presented in Figure 5. Northern countries prefer IR to all other arrangements, except when cost differences or trade costs are low. The intuition is that if Northern countries are willing to trade market access, they are wary of doing so with low cost countries, as it may disproportionately injure their domestic sector. On the other hand, in Figure 6, Southern countries tend to prefer lots of additional market access via FT and ER unless trade costs are high. The intuition is that their domestic sector suffers little from high-cost import competition, and benefits greatly from increased market access to markets with less competitive firms.

Putting Figure 5 and Figure 6 together, the trading arrangements which remain undominated in equilibrium are identified in Figure 7. Again, the heavy dashed line represents the outer locus of points such that bilateral trade between all countries occurs for all trading arrangements. Other lines represent the indifference points between the three remaining undominated trading arrangements.

As an analytical benchmark, the result from Proposition 1 is on the horizontal axis, and the result

[7] Both ER and FT also dominate NA for a majority of the relevant parameter space. However, if cost asymmetries are high, firms in N will prefer ER and FT to NA, since NA offers more protection from low cost import competition. However, NA is still dominated by the IR as illustrated in Figure 4.

Figure 5: Preference conditions - Northern Countries

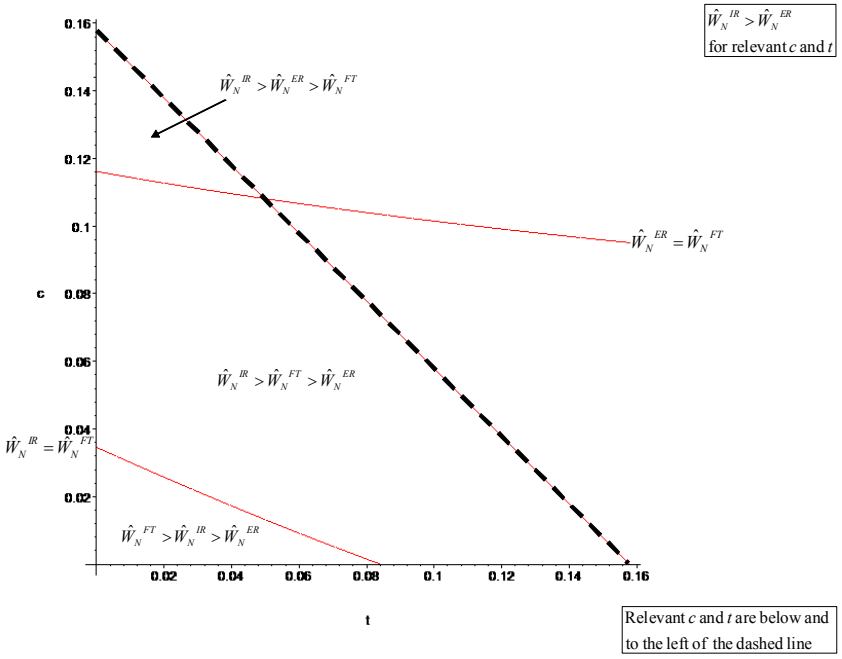


Figure 6: Preference Conditions - Southern Countries

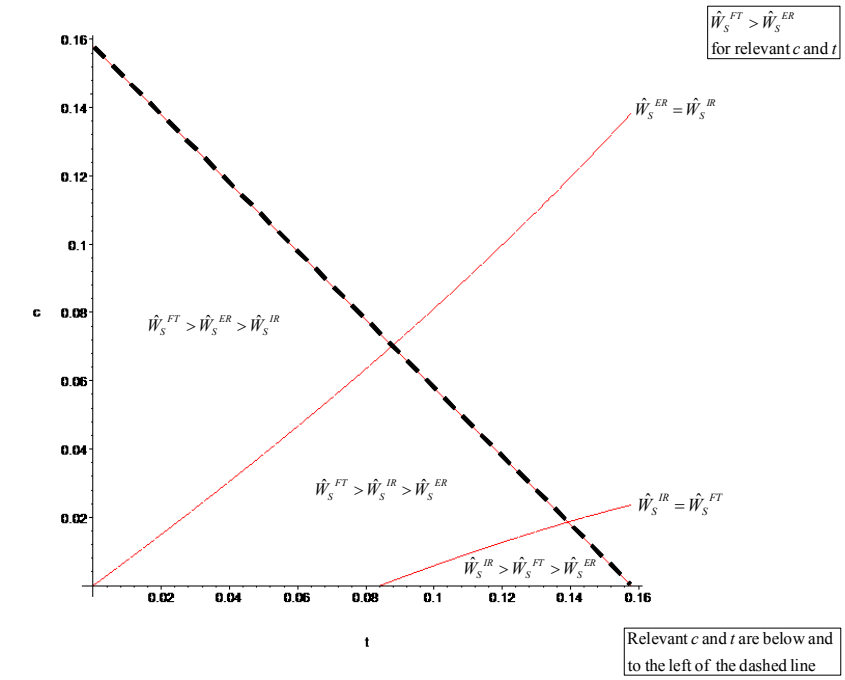
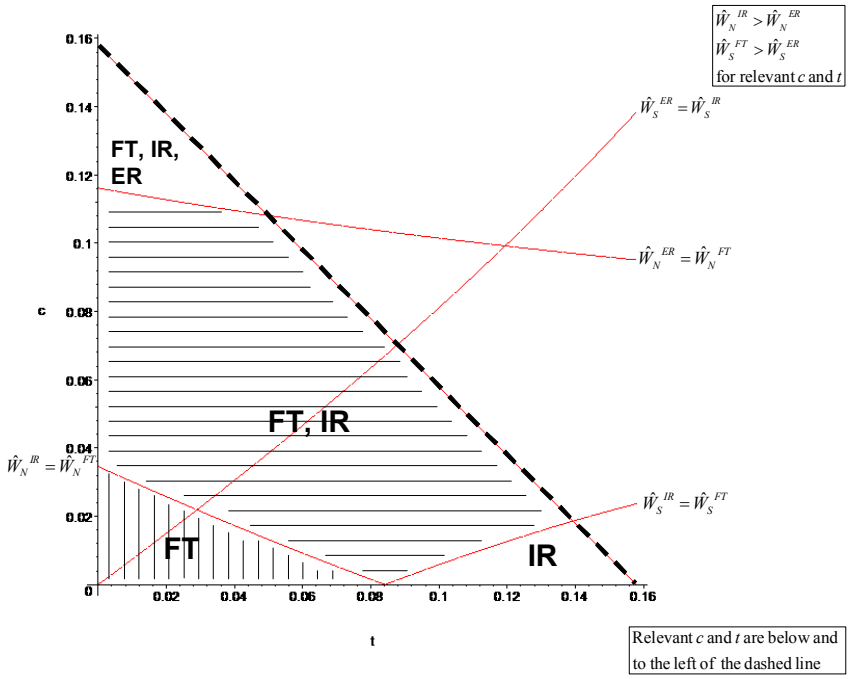


Figure 7: Undominated Trading Arrangements



from Proposition 2 is on the vertical axis. In between, using the results from Lemmas 1-3 and Proposition 1, regions can be identified by the trading arrangements which remain undominated.

For a majority of the range of tariffs and regional cost differences such that trade occurs for all equilibrium arrangements, no one equilibrium outcome is dominant. That is, with multiple trading arrangements that remain undominated, countries cannot agree on a unique equilibrium coalition. This no-agreement outcome is more likely when cost differences are high, where as cost differences increase, the number of undominated trading arrangements also tends to increase. In addition, the fraction of the parameter space which supports no agreement also increases. When cost differences are low, as in Proposition 1, global free-trade is optimal when trade costs are relatively low, and regional agreements are optimal when trade costs are relatively high.

The intuition for this result is that as cost-differences between regions increase, high-cost countries wish to collude within a regional agreement to act as a buffer from low-cost import competition. Of course, the incentive of low-cost countries is exactly the opposite, as they can gain substantially from unrestricted market access to countries with less-competitive firms. Eventually, as this cost-difference becomes large, this dichotomy becomes prohibitive, and there exist no parameter values such that agreement is possible.

6 Discussion and Conclusion

The results in the previous section highlight the difficulty in forming trading coalitions which benefit all members. While the model is quite stylized, the intuition should extend to other settings. One remaining question is whether such a result can be derived from a model with elements of comparative advantage. This is an area of current research. However, despite its stylized features, the current model is well-suited to address a number of final points.

Building blocks or stumbling blocks?

A focal point in the debate over regionalism and multilateralism is whether the permissibility of preferential agreements within the GATT is a help or a hindrance. As coined by Bhagwati, are regional agreements "stumbling blocks" or "building blocks" toward global free trade?

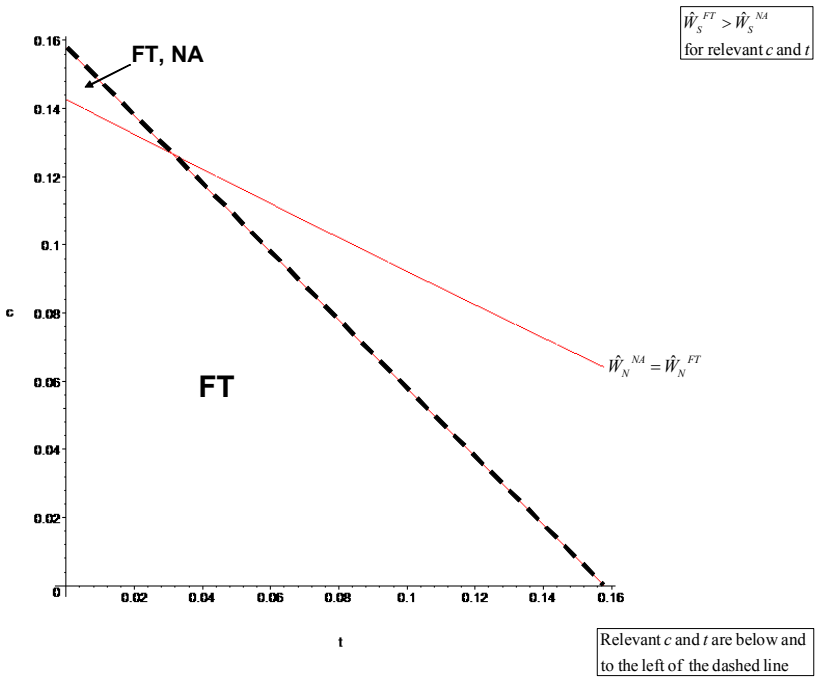
Many authors have provided competing viewpoints regarding how preferential agreements affect the incentives for multilateral cooperation. As stated earlier, Aghion, Antras, and Helpman (2007) have addressed this within an extensive form model of cooperation. A leader country chooses the multilateral or preferential track, and follower countries make decisions on whether to accept agreements or not. They show that the building or stumbling nature of preferential agreements is based on the form of coalition externalities. Saggi and Yildiz (2007) offer another approach, showing that the answer to this question depends on whether countries are symmetric. Interestingly, if countries are asymmetric, there can exist a strong building bloc effect of preferential agreements.

In contrast with Aghion, Antras, and Helpman (2007), I do not assume any timing or dynamic structure of how trade agreements are formed. Simply, I assume that all decisions are made jointly and cooperatively. All countries must be made better off relative to other options which are feasible. In Aghion, Antras, and Helpman (2007), this is only required relative to the subgame in which follower countries make their decisions.[8] In Saggi and Yildiz (2007), agreements and deviations are made non-cooperatively by an announcement game. Thus, one member of a current agreement could leave, ignoring the impact on each other member of the agreement. In terms of the equilibrium concept, this is important as my model uses a cooperative framework. Under such a deviation, my model dictates that unless members whose organization structure changes are made better off, there is no dominance relationship between one agreement and another.

Despite these differences, the model is still equipped to examine the building or stumbling bloc aspects of the agreement equilibrium. The results from doing so are illustrated in Figure 8. Here, the equilibrium coalitions which remain undominated are labeled. Since IR and ER are prohibited, they are trivially out of the picture. However, it is clear that multilateral free trade, FT, is the dominant outcome for a majority of the relevant parameter space. For a small region in which trade costs are small and cost asymmetries are large, NA also remains undominated. The intuition here is that for

[8] An extension of their model which would bring it closer to mine would be allowing the two followers the option to sign a preferential agreement at the time of the leader choosing between the preferential and multilateral tracks. Thus, the leader may be negotiating with two partner countries which have already signed a preferential agreement.

Figure 8: Equilibrium Coalitions - Prohibited Preferential Agreements



large cost asymmetries, high-cost countries wish to have some buffer against cheap foreign imports.

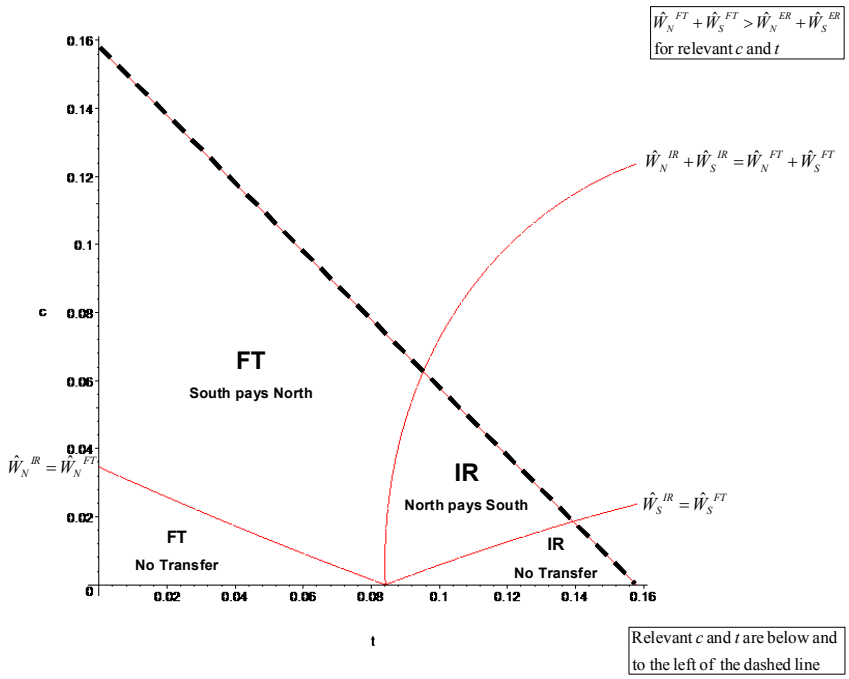
Overall, the results in Figure 8 suggest that preferential agreements, and in particular those with regional trading partners, are a stumbling block in an effort to achieve multilateral free trade. This is in contrast with Figure 7, where for a non-trivial portion of the parameter space, IR is the dominant equilibrium outcome. When IR is prohibited, FT replaces it as the equilibrium outcome.

However, this result ignores an important point: free trade should not be the goal if intraregional agreements improve welfare for all parties, which is the case in Figure 7. Furthermore, I have yet to examine how transfers may expand the region of parameter values such that one equilibrium is welfare improving for all parties.

Transfers

Is there scope for transfers to facilitate greater cooperation and an equilibrium trading arrangement which maximizes world welfare? The short answer is yes, where allowing for transfers greatly simplifies the cooperative solution of the model. To see this, suppose that over some parameter space, N countries prefer IR but S countries prefer FT. To convince N countries to agree to FT, S countries must be able to offer a transfer greater than or equal to the welfare loss in moving to free trade. Such a

Figure 9: Equilibrium Coalitions with Transfers



transfer will exist if:

$$\begin{aligned} \widehat{W}_S^{FT} - \widehat{W}_S^{IR} &> \widehat{W}_N^{IR} - \widehat{W}_N^{FT} \\ \widehat{W}_S^{FT} + \widehat{W}_N^{FT} &> \widehat{W}_S^{IR} + \widehat{W}_N^{IR} \end{aligned}$$

That is, total welfare under free trade must be higher than the total welfare under no agreements. This will be the metric by which the global optimum arrangement will be chosen, allowing for transfers to facilitate such an arrangement.To begin the analysis, note that since both parties prefer IR to NA in Figure 4, it must also be the case the the total welfare accrued within IR must be greater than the total welfare accrued in NA. The preference conditions for other arrangements are illustrated in Figure 9. For the complete set of relevant parameters, the welfare accrued under free trade, FT, is greater than the welfare under a extraregional agreements, ER. Thus, I have omitted the non-binding locus where IR equals ER.

However, there is a relevant choice between IR and FT. In Figure 9, I have labeled the global preference locus, $\widehat{W}_N^{IR} + \widehat{W}_S^{IR} = \widehat{W}_N^{FT} + \widehat{W}_S^{FT}$, and those specific to each region, $\widehat{W}_N^{IR} = \widehat{W}_N^{FT}$ and $\widehat{W}_S^{IR} = \widehat{W}_S^{FT}$. Generally, for relatively high trade costs, IR is the preferred outcome. Conversely, for low trade costs, free trade is the preferred outcome. As cost asymmetries increase, these outcomes can only be reached via a transfer scheme. When IR occurs, the North must pay the South to compensate for their loss in market access relative to FT. In contrast, when FT occurs, the South must pay the North to compensate for the injured domestic sector relative to IR.

Not surprisingly, agreement is possible if we allow for the winners to compensate the losers. However, in contrast with Figure 7, the striking feature is that transfers become more necessary as cost-asymmetries increase. That is, compensation via reciprocal market access is less likely to be a sufficient catalyst for a mutually beneficial trade agreement as cost asymmetries become large. Eventually, if these cost asymmetries are sufficiently high, non-market transfers are the only way in which to avoid trade disagreement.

Future directions

Clearly, this model is very stylized, and a remaining question is how different modeling assumptions would increase or decrease the parameter space in which countries can mutual gain from a trade agreement. However, the intuition of the model is likely to go through, since countries may wish to cooperate only with countries having similar objectives.

Despite this, there are three extensions which I plan to consider. The first is using a Krugman-style model of comparative advantage to measure the scope for agreement in trade negotiations. For example, as countries tend to specialize in the same products, how do the incentives described above change? Is the oligopoly set-up a critical determinant of the large space of parameters which support disagreement?

Another extension would be extending the basic trading environment within this model to the extensive form model of Aghion, Antras, and Helpman (2007). In my model, a large portion of the parameter space yields an equilibrium in which countries do not agree on a unique first-best trading arrangement. However, they can mutually agree over the entire parameter space that a regional agreement is preferred over the full non-cooperative outcome. Can this result explain why regional agreements are the predominant choice in liberalizing trade? That is, given a future subgame in which free trade would be chosen by low-cost countries, would high-cost countries prevent that subgame from ever being reached by operating only at a regional level?

I also plan to test the predictions of this model empirically. While challenging, I intend focus on the length of negotiations, the size of market-based concessions, and the extent to which non-market concessions are offered to gauge the degree to which parties naturally disagree. Also, I intend to ascertain whether there are a sufficient number of failed agreements to build a database of negotiation success and failure.

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