Are Preferential trade Agreements with Non-trade Objectives a Stumbling Block for Multilateral Liberalization?

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Abstract

Increasingly, in regional agreements, large economies, e.g. U.S. and E.U., offer lower trade barriers in exchange for cooperation in environmental, intellectual property and other issues by small economies. What is the effect of such agreements on multilateral trade liberalization? We show that, even in the absence of trade creation or diversion, regional agreements increase the cost of multilateral tariff reductions. Such reductions decrease the threat large countries can use in regional agreements causing a loss in regional bargaining power. By explicitly modeling the interaction between regional and multilateral negotiations we show that this result is due to the WTO's most-favorite nation rules and analyze the welfare effects of strengthening and weakening them. Moreover, we show that, under the current MFN rules, "deepening" duty-free regional agreements requires increases in multilateral tariffs.

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1 Introduction

There has been an enormous proliferation of preferential trade agreements (PTAs) in the last 20 years.[1] Unlike earlier PTAs, which were largely either between developed or between developing economies, an increasing number of the recent PTAs involve both types of countries. Another distinguishing feature of an important number of these recent PTAs is that large developed economies offer to lower their effective trade barriers on the exports of smaller less developed ones in exchange for explicit cooperation in different non-trade issues such as labor, environment and intellectual property. This is the case with the Eastern European and Mediterranean agreements signed by the EU; the US agreements with Mexico, Jordan and certain Caribbean countries; and the preferential tariff treatment that both the EU and the US extend to numerous developing countries through the generalized system of preferences. We refer to this type of PTAs as Large-Small PTAs (LSPTAs).[2,3]

Both the US and some EU members have demanded similar concessions on non-trade issues in multilateral trade negotiations (MTN). This type of multilateral linkages was a contentious issue during the last round of MTN and was also an important cause for the breakdown of the launch of a new round of MTN in Seattle.[4] Fear that such linkage demands will block further multilateral trade liberalization has prompted suggestions that linkage should be pursued bilaterally if at all. However, there is no analysis of the effect of bilateral linkages on MTN so it is unclear if this suggestion would

[1] From 1948-94 there were 124 notifications to the WTO of distinct PTAs being formed by its members. Since 1995 alone there were an additional 90. <http://www.wto.org/english/tratop_e/region_e/regfac_e.htm>

[2] World Bank (2000) and Perroni and Whalley (1994). The latter is particularly clear on this point:

> "[T]hese new regional arrangements are the outcome of smaller countries with little negotiating power seeking safe-haven trade arrangements with larger countries, primarily so as to make their access to large markets more secure. In the resulting agreements, larger countries have been able to both extract a price for their participation, largely in the form of non-trade concessions, as well as enhance their power in bloc-wide negotiations." (p.1)

Unlike most "concessions" negotiated in the context of the GATT, the GSP did not require reciprocal concessions on the part of the developing countries. However, as Jackson (1997) points out "during the last twenty-five years or so the experience of the GSP in the GATT system has been that for a number of reasons the preference-granting national entities (i.e. the industrialized countries) often succumb to the temptation to use the preference systems as part of 'bargaining chips' of diplomacy." (p. 160)

[3] See Elliot (2000), Bayard and Elliot (1994) and UNCTAD (1998) for details on conditionality in the GSP program. Perroni and Whalley (1994) and references therein provide details on conditionality in NAFTA whereas Winters (1993) and Grilli (1997) address the EU's Eastern European, Mediterranean and GSP programs.

[4] The Uruguay Round included an agreement on Intellectual Property Rights which requires compliance with internationally agreed principles under the threat of trade sanctions. In an interview with the Seattle Post-Intelligence President Bill Clinton stated:

> "I think that what we ought to do first of all [is] to adopt the United States' position on having a working group on labor within the WTO, and then that working group should develop these core labor standards, and then they ought to be a part of every trade agreement, and ultimately I would favor a system in which sanctions would come for violating any provision of a trade agreement."

further multilateral trade liberalization.[5]

Ultimately, we are interested in determining the tariff and welfare effects for large and small countries of different linkage alternatives. To do this we must first understand the interaction between bilateral linkages, through LSPTAs, and MTN. Thus the first question we address is does the possibility of forming LSPTAs promote or block multilateral trade liberalization.

A related question, whether PTAs are building or stumbling blocks towards multilateral trade liberalization, has been extensively analyzed but the results of that literature are not applicable here for two reasons.[6] First, the earlier literature has focused on the effects of traditional PTAs, common in the 60's, which rarely took place between large developed and small poorer countries. Moreover, the explicit focus of traditional PTAs was on reductions in trade barriers which can lead to trade creation but may also lead to a diversion of trade from a more efficient source towards its preferential partner. Trade creation and diversion effects are then the major driving forces behind the different building/stumbling theories of the existing literature. Empirically however, there is no consensus on the importance and direction of such effects.[7] Second, the existing literature does not address the linkage of trade with domestic policy issues that has been at the core of LSPTAs.[8] As Panagariya notes in his recent thorough review of PTAs:

> "Also excluded from consideration [in his review] are issues such as ... harmonization of domestic policies. Though these issues figure in the current policy debate, they have not

For this reason the "US media ... laid the blame for last week's failed WTO meeting squarely on Bill Clinton's doorstep, accusing the president of mishandling Washington's international trade strategy." In : "US media blame Clinton for failed WTO meeting", Agence France Presse, December 5, 1999.

[5] This point has been noted by trade lawyers in the context of the GSP but not yet analyzed, in the conclusion of a chapter on trade and labor rights, Trebilcock and Howse (1997) assert that the GSP system is important in holding back MFN concessions:

> "The main impact of this lack of agreements [regarding labor rights in the context of the WTO] is that some of the most powerful developed countries will continue to impose their own sanctions through the withdrawal of GSP preferences- measures that are perfectly legal under existing multilateral trading rules. By failing to respond to the demand for a social clause within the WTO, the Organization has simply created an incentive for developed countries to make fewer offers for tariff cuts on an MFN basis in future rounds of negotiations (especially on products of interest to developing countries), so as to preserve the impact that comes from being able to grant–and withdraw–GSP treatment. This is a consequence that free traders who are dogmatic opponents of a place within the WTO for permissible trade sanctions should consider more carefully." (p.462-463).

I thank Kyle Bagwell for pointing out this quote.

[6] This terminology was introduced by Bhagwati (1991). See the review of PTAs in Panagaryia (2000) and Winters (1996) and the references therein.

[7] See for example Frankel (1997) and World Bank (2000). Most of the empirical work on creation and diversion effects has not focused specifically on Large-Small PTAs. In this regard the evidence from the effects of GSP preferences on developing countries' exports is useful. According to Gillson (p.4,5) there is little evidence for the creation of trade due to GSP preferences, one of the studies he surveys concludes that the "failure can be increasingly associated with supply-side constraints amongst the GSP beneficiaries."

[8] In contrasting the earlier wave of PTAs and the more recent one, Ethier states that: "...the Vinerian paradigm

been seriously addressed in the theoretical literature." (2000, p.288).

This is the fundamental gap we address. This paper is a first step in taking these non-trade issues seriously and showing that, even in the absence of significant trade creation or diversion effects, preferential trade agreements can have an important effect on the multilateral trading system.

We model the world as consisting of two symmetric blocks of countries, each containing a large and a small country. Large and Small's governments choose trade policies and an externality tax (e-tax) used to finance a public good. The latter may be interpreted as the enforcement of labor or environmental standards or human rights for example. There exist two international externalities within each block. First, Large's trade policy affects its terms-of-trade (TOT) but Small's does not. Second, the level of the externality in Small affects Large directly (e.g. cross-border pollution or "psychological" cost associated with human/labor right violations) and we assume that Small places a negligible weight on that externality, so it is indifferent to Large's policy concerning this externality. Two governments within a regional block can internalize these effects through a LSPTA, that is by bargaining over the levels of their tariffs and e-taxes. The bargained solution must be self-enforcing so that Small only agrees to increase its e-tax if Large reduces its trade barriers. Otherwise they each set their policies non-cooperatively. Cooperation is enforced because countries interact repeatedly. Importantly, we construct our model such that the LSPTA does not entail trade creation nor diversion.

We first show that, for given tariffs between the large countries, a LSPTA constitutes a *strict* Pareto improvement over no cooperation for both Large and Small. Moreover, this is the case even if Large has all the bargaining power and makes a take-it-or-leave-it (TOL) offer to Small. This is a useful benchmark because it means that, while negotiating multilateral tariffs with the other block, large countries know that if they subsequently propose a LSPTA to the small country in their own block, it will be accepted.[9]

Across blocks, only the TOT externality between the large countries is present. Multilateral trade negotiations address this externality and have the following characteristics. First, the equilibrium

of trade creation versus trade diversion drove analysis of the former, but it is by no means clear that it should drive the analysis of the latter. Yet it *has*." (1998, p. 1215) Fernandez and Portes (1998) discuss a number of different non-traditional returns to forming a PTA. A rare exception of a PTA model that explicitly addresses non-trade issues is Schiff and Winters (1997). They explicitly model the motivation for a PTA between two small, specialized countries as arising from the increase in security (which is valued directly in the utility) due to higher imports from each other. They show that a subsidy on imports from the regional partner, or alternatively a tax on imports from the rest of the world coupled with domestic taxes, is one of the social optimum solutions. In addition, an enlargement of this trade block has a positive welfare effect on all three countries and an ambiguous effect on the original two-country block's common external tariff. However, because the countries modeled are small relative to the rest of the world, we cannot infer any implications from the formation of such a PTA as regards other countries' tariffs.

[9] Provided that the threat Large countries make to Small if the latter refuses the LSPTA is credible in a sense we make clear later.

multilateral tariffs negotiated maximize the large countries' joint welfare, because we assume that small countries have no power over multilateral negotiations. Second, those tariffs must be incentive compatible from the perspective of the large countries. That is, they must balance the incentive to deviate from the multilateral trade agreement against the future losses from non-cooperation by the other large country which are triggered by such a deviation. The exact trigger depends on which of the following three regimes large countries are negotiating under.

The status quo regime involves a LSPTA exception to the Most Favored Nation rule (MFN). Currently, a reduction in tariffs between two WTO members must be extended to the remaining members; this is the essence of the MFN rule, which is one of the pillars of GATT. If strictly applied, MFN implies that LSPTAs are not possible because Large would have to extend the lower LSPTA tariff to the large country in the other block. However, GATT rules allow exceptions in the form of lower than MFN tariffs.[10] So, under the **LSPTA exception to the MFN rule**, the upper bound for Large's tariffs on Small's exports is the MFN value and the lower bound is zero. We contrast the status quo both with a regime when large countries have a strong commitment to MFN and when they have a weak commitment to MFN. A **strong commitment to MFN** requires large countries to always set non-discriminatory tariffs on both partners and therefore precludes LSPTAs. A **weak commitment to MFN** entails non-discriminatory tariffs as long as large countries are cooperating on the bilateral tariffs between themselves but *not* during a trade war. During a trade war between large countries each of them is free to use discriminatory tariffs and therefore sign a LSPTA. The three different regimes just described lead to different incentive constraints for the multilateral MFN tariffs that can be sustained as a subgame perfect equilibrium and therefore to different levels of those tariffs.

The first important result is that a LSPTA exception to MFN is a stumbling block towards multilateral trade liberalization relative to the case when large countries have a strong commitment to MFN. That is, the lowest MFN tariff that can be sustained (i.e. which is self-enforcing) under the LSPTA exception is *higher* than that under strong commitment. This occurs because under the LSPTA exception the threat point for Large in its bilateral relationship with Small is the MFN

[10] Currently, three important provisions in WTO rules relating to trade in the context of PTAs constitute exceptions to the MFN rule. For a PTA to be GATT-legal it must fall under either article XXIV, the Enabling Clause or article V of GATS (which deals with trade in services). Article XXIV can be used by any country if: i) the tariff reductions are reciprocal and eventually zero, ii) the agreement covers substantially all trade and, iii) when a common external tariff is adopted, it does not exceed the average of the existing tariff of the member countries in the preferential agreement prior to it. These three conditions are waived for PTAs among developing countries under the Enabling Clause. Since 1979 the Enabling Clause also encompasses the Generalized System of Preferences (GSP). The GSP was originally granted as a 10-year waiver from MFN in 1971 (Jackson 1997, p. 164). According to the GSP developed countries may offer tariffs below the negotiated MFN values to developing countries in a non-reciprocal fashion.

tariff level. Therefore, any reductions in the MFN tariff reduce Large's bargaining power during a LSPTA negotiation. This makes MFN tariff reductions less attractive at the MTN stage under the exception than under strong commitment. This result implies that tackling non-trade issues through preferential agreements can actually block further reductions of multilateral tariffs.

The second result is that a LSPTA exception to MFN is a building block towards multilateral trade liberalization relative to the case when large countries have a weak commitment to MFN. That is, the lowest MFN tariff that can be sustained under the exception is *lower* than that under weak commitment. The basic intuition for this result is that under weak commitment large countries are not required to set non-discriminatory tariffs during a trade war. Therefore, the incentives to deviate from the MFN tariff are even higher than under the exception since, in addition to the payoff from cheating on the large country in the other block (which is the same as under the exception), there is an extra gain from being able to sign a LSPTA with Small in that same period. In addition the gains from cooperation are lower under weak commitment given the absence of a LSPTA.

According to these two results, governments must be extremely careful when deciding whether to enforce the MFN rule multilaterally. If they do not have enough instruments to enforce compliance with MFN in periods of trade wars then this weak commitment leads to higher multilateral tariffs relative to the exceptions currently allowed by WTO rules. On the other hand, if governments can credibly sustain a strong commitment then lower MFN tariffs are enforceable. We discuss alternative trigger strategies that enforce strong and weak commitment.

These two results imply that WTO rules may have to address preferential agreements which do not lead to trade creation or diversion and deal with purely regional issues. However, some of the non-trade issues proposed for inclusion in the WTO have global spillovers. We show that in this case the results above are reinforced. So, for example, the most cooperative tariff under the LSPTA exception will be higher than when the spillovers are regional. The higher tariff reflects the extra benefit for large countries from increased cooperation in LSPTAs in the opposite regional block.

What is the effect of "deepening" LSPTAs on multilateral tariffs? Exogenous increases in the weight Large places on the public good will lead to reductions of the preferential tariff and increases in Small's provision of the public good at given multilateral tariffs. However, we show that if the initial LSPTA is duty-free the only way to achieve deeper regional integration is to increase the level of the multilateral tariff and thus the threat Small faces. We infer two points from this result. First, the stumbling block effect is particularly important when Large places a high weight on the public good, because the most cooperative tariff under strong commitment is independent of that weight. Second,

if the importance of such regional spillovers is increasing, the model predicts that the multilateral tariffs of a good imported from a LSPTA partner should be increasing as well. Alternatively, if we specify an (exogenous) gradual multilateral liberalization process, the prediction is that, under a LSPTA, multilateral tariff liberalization is slower for those goods that are also regionally imported.

A government does not, or at least should not, choose to bind itself by an agreement in order to achieve a particular outcome in terms of the level of a policy such as lowering multilateral tariffs. It typically chooses to do so if this maximizes its objective function; therefore we proceed by modelling the choice of regime. The timing of governments' actions in each period of the repeated game is described in figure 1. The aim is to answer the following question. If large countries choose the multilateral trading rules to maximize their own objective functions, would they ever choose weak or strong commitment over the LSPTA exception? We also discuss if and when the chosen regime is the one also preferred by small countries.

We show that large countries always choose the LSPTA exception over weak commitment to MFN. This is both because the MFN tariffs sustainable under the exception are lower and because the LSPTA is always Pareto improving for given MFN tariffs. However, large countries choose a strong commitment to MFN over a LSPTA exception if Small countries discount the future heavily and therefore cannot sustain much cooperation through a LSPTA. To understand this result consider the extreme case where Small places no weight on the future. In this case, the LSPTA cannot sustain any cooperation between Large and Small. Large then sets a non-discriminatory tariff both under the commitment and the exception regime. But, as we argue above, the level of this tariff is higher under the exception because, under this regime, the *possibility* of using discriminatory tariffs and signing a LSPTA creates both a higher incentive to deviate and a lower incentive to cooperate. So, Large still faces the cost from the LSPTA exception regime, in the form of higher multilateral tariffs, but not the benefit because it gets no cooperation through the LSPTA. More generally, whenever the gains from the LSPTA are sufficiently small relative to the cost arising from maintaining a higher MFN tariff, Large prefers a strong commitment rather than an exception to MFN.

Finally, in relation to the optimal regime for Small, we discuss two simple points. First, that even though, at given multilateral tariffs, a LSPTA is welfare improving for Small, it may prefer either of the commitment regimes to the LSPTA. Second, we provide a scenario under which the optimal regime for small and large countries coincide and another in which they diverge.

The structure of the paper is the following. In section 2 we develop the regional blocks' model. In section 3 we derive the equilibrium policies under the LSPTA for given MFN tariffs. Next we

analyze multilateral trade liberalization and the role of LSPTAs as stumbling or building blocks. In section 5 we analyze the effects of deepening regional integration, extend the results to deal with global spillovers and study the optimal MFN regime for large and small countries. We discuss our conclusions in section 6.

2 A model of Large-Small PTAs

We start with a description of the economic structure underlying the objective functions, the role of the government and then the pattern of trade within and across regional blocks.

2.1 Economic structure of the regional blocks

There exist two symmetric regional blocks. Each block is composed of two economies, Large and Small. The names refer to a country's size in the traditional trade sense; that is, trade policy changes in Large, but not in Small, have an important effect on the country's TOT relative to its partners. This difference will be accomplished by assuming that Large has larger endowments of the (non-numeraire) traded goods and therefore higher income. Income is in turn the basis for Large's dominating bargaining power at the regional level. However, Small must be important in the non-trade dimension; otherwise, Large would not seek its cooperation on non-trade issues. Therefore, both countries have the same population so that Small can have an important weight in terms of certain non-trade issues which are plausibly proportional to the labor force, e.g. human rights, labor rights or environmental externalities.

We initially describe the general features of the model that are common to both countries in the block and then present the restrictions that distinguish them. Each country, $j = L,\ S$, has a population of H individuals, each endowed with one unit of labor. In both countries, the numeraire good, n, is produced according to a constant returns production process, $N^j = h_n^j$. In Large each individual is endowed with one unit of each of the non-numeraire goods $i = l,\ s$. In Small each individual is endowed with $1/k$ units of good l.[11,12]

The representative consumer in each country has quasilinear preferences for the private goods

[11] It is straightforward to extend the model by allowing production in l and s if this is done by assuming that it follows a constant returns process that uses labor and a specific factor in fixed supply. The difference in goods endowments would then translate into the fixed factors. If in addition we assume that the production process achieves a maximum after which labor's marginal product is zero the supply then becomes price inelastic as in the case of fixed endowments.

[12] Henceforth, we use superscripts to define the country and subscripts for the good. Subscripts are also used to define the partial derivative with respect to a variable unless the function has only one argument in which case we use a prime.

and a public good, E:

$$U^j \equiv c_n^j + \sum\nolimits_{i=l,s} u_i^j(c_i^j) + \bar{\Psi}^j(E^j, E^{\setminus j}) \tag{1}$$

The subutility functions for the non-numeraire goods, u, are twice continuously differentiable and strictly concave. We assume a quadratic form that gives rise to linear demand curves (as well as $u(0) = 0$) and allow demands to differ across countries. The subutility function for the public good is also concave in each of its arguments and takes the form:

$$\bar{\Psi}^j(E^j, \alpha E^{\setminus j}) \equiv \lambda^j \Psi(E^j) + \alpha^j \lambda^j \Psi(E^{\setminus j}) \qquad \alpha^j, \lambda^j \geq 0; \Psi' > 0; \Psi'' < 0 \tag{2}$$

The weight placed on the public good, λ^j, varies across countries.[13] The provision of the public good in one country affects the other country in the same block directly if α^j is positive. Therefore, this parameter can be interpreted as the degree of the regional cross-border effect. This public good may be interpreted fairly broadly as public expenditures used for cleaning up a particular environmental externality that has a cross-border effect or for enforcing certain laws, e.g. protecting human rights or labor rights.[14] We discuss its production and financing below.

For given prices and taxes the individual's problem reduces to choosing the quantities of the private goods it consumes to maximize its utility subject to a budget constraint, $c_n^j + \sum_i p_i^j c_i^j \leq y^j$. Given the assumptions on the subutility, the budget constraint is satisfied with equality and individuals demand $d_i^j(p_i^j) = u_i^{j\,\prime}(p_i^j)^{-1}$ of each of the non-numeraire goods. Substituting c_n^j and the demand for l and s in the utility we obtain the individual's indirect utility function:

$$W^j/H^j = y^j + \bar{\Psi}^j(E^j, E^{\setminus j}) \; + \sum\nolimits_i v_i^j(p_i^j) \tag{3}$$

where the last term on the RHS represents consumer surplus from the non-numeraire goods.[15]. We make the following assumptions regarding Small's preferences. First, we are interested in the case where Large places a higher weight than Small on the provision of the public good. Therefore, without loss of generality for the qualitative results, we focus on the extreme case where Small places no weight on the public good. Second, we want to ensure that no trade diversion or creation effects take place due to the LSPTA. As we show below, this requires a particular trade pattern and the simplest way

[13] We also assume the following: $\Psi(0) = 0$; $\lim_{E\to\infty} \Psi(E) \leq \bar{\psi}$; $\lim_{E\to 0} \Psi'(E) = \infty$.

[14] Some of these issues arguably have global effects. As we show in section 5.2 our results also hold when spillovers are global, therefore the present interpretation of the public good is justified.

[15] With quadratic functions, $u = \frac{1}{b}(ac - c^2/2)$, the demand for a given non-numeraire good is $d = a - bp$. In this case we have: $v = u(d(p)) - pd(p) = \frac{1}{2b}(a - bp)^2$.

to obtain it is to assume that Small does not derive utility from either of the non-numeraire goods. Thus the indirect utility for individuals in Small is simply given by their income.[16]

An individual's income sources are the wage, the proceeds from the sale of the endowment and net taxes. The latter are equal to the per capita tariff revenues, t, net of the e-tax, e, used to finance the public good where both of these are lump-sum.[17]

2.2 Role of the government

The government has two roles, it sets the trade policy, which consists of tariffs on the imported non-numeraire goods, and supplies the public good in order to maximize domestic aggregate welfare, W^j. The public good is produced according to a constant returns technique, $E^j = b^j h_e^j$. The marginal productivity of labor in public good production, b^j, may vary across countries; for example, it may be more costly to provide the public good in Small in terms of foregone units of the numeraire. The government finances the labor costs, $w^j h_e^j$, only through the lump-sum e-tax.[18] Given that we assumed that the subutility function for the public good is bounded (eq.2) we have, without loss of generality, that the optimal amount of its provision, $\bar{E}$, (optimal in a sense to be determined later) does not exhaust the labor force, that is $H^j > \bar{E}^j/b^j$. This implies that the numeraire will always be produced in equilibrium and therefore the wage is fixed at unity, the marginal productivity of labor in the numeraire good. This assumption regarding the size of the labor force also ensures that it is feasible to finance $\bar{E}^j$ from the total proceedings of the lump-sum tax, $H^j e^j$, since an individual is always assured a unit of the numeraire. Finally, imposing a balanced budget condition implies that, in equilibrium, the amount of public good provided is $E^j = b^j H^j e^j$.[19]

The trade policy instruments available are specific tariffs on the (non-numeraire) imported goods. The governments also have to decide on their trade policy strategy, namely whether to pursue PTAs and, in the case of Large, multilateral trade agreements and the associated rules. Before dealing with this let us analyze the trade pattern.

[16] As we show in a previous version of this paper the required trade pattern and the fundamental results hold even if Small values the non-numeraire goods.

[17] Therefore individual income in Large is $y^L = w^L + \sum_i p_i^L + t^L - e^L$ whereas in Small it is $y^S = w^S + \frac{1}{k} p_l^S + t^S - e^S$.

[18] All the tariff revenue is distributed lump-sum and none of it can be used to finance public good provision. The reason not to unify the government's revenues on tariffs and e-taxes is to maintain the policies separable in the game that follows. A parallel for this is social security in the U.S. which has its own budget line. For developing countries however this assumption is clearly unrealistic since an important motivation for imposing tariffs in those countries is precisely to finance public goods.

[19] An alternative interpretation of b^j is that it represents the taxation efficiency in j. Suppose production is $E^j = h_e^j$ which again is the labor cost. This is financed by charging a tax of $H^j e^j$ but only a share b^j is collected. Therefore the balanced budget condition is now $b^j H^j e^j = h_e^j$, so the amount provided in equilibrium must be $E^j = b^j H^j e^j$.

2.3 Trade pattern

The trade pattern is illustrated in figure 2. The two large countries have similar endowments, therefore their trade pattern is determined by demand differences. We assume that Large has a stronger preference for good l relative to s (due to symmetry, Large* has a stronger preference for s). Therefore, Large imports good l and exports good s to Large*. Small countries export their respective endowments to the large countries since they do not value them in consumption, therefore Small exports H/k units of good l, and Small* exports H/k units of good s.[20]

In the absence of discriminatory tariffs small countries always export to the large country in their own regional block. However, if Large sets a higher tariff on Small's exports of good l than on those of Large*, Small could choose to sell in Large*. We rule out this possibility that a country, Large* in this case, simultaneously imports and exports a homogenous good, by assuming that the trading costs between a small and a large country in the opposite block are prohibitive. There is a compelling reason for this assumption as well as for the endowment and preference structure, to neutralize trade diversion and creation effects. As we explain in the introduction, this is precisely what we want: to determine the impact of LSPTAs on multilateral tariffs in the absence of such effects.

In the present setup small countries do not have an incentive to use tariffs since they do not import any of the non-numeraire goods. Such a motivation could clearly be modelled but changes in such tariffs are not an important part of the effects for Small countries of the types of PTAs we are interested in discussing. For example, the agreements under the GSP system do not require developing countries to change their tariffs.[21] For PTAs under GATT's article XXIV it has often been noted that even though countries are required to substantially remove all tariffs on the PTA members they often do not comply.[22] When, in the wake of such PTAs, trade liberalization by the smaller less developed countries has taken place it has often been a result of a shift in ideology from import substitution towards unilateral liberalization.[23]

[20] The balance of payments condition is satisfied through movements of the numeraire good.

[21] Unlike most "concessions" negotiated in the context of the GATT, the GSP did not require reciprocal concessions on the part of the developing countries. However, "during the last twenty-five years or so the experience of the GSP in the GATT system has been that for a number of reasons the preference-granting national entities (i.e. the industrialized countries) often succumb to the temptation to use the preference systems as part of "bargaining chips" of diplomacy." (Jackson, p.160) An important reason for this is that "the preferences extended under the GSP are privileges rather than enforceable rights". (UNCTAD 2000, p. 19). Which means that granting countries can withdraw preferences in a GATT-legal way, that is without being subject to (GATT sanctioned) retaliations.

[22] Only 6 of 69 agreements reported to the WTO until 1994 and which fall under Art. XXIV were found to be in compliance with that article (WTO 1995, p.16).

[23] See for example Ethier (1998) and Foroutan (1998, p.8) on Mexico, Israel and Turkey. Some may argue that even though the liberalization preceded the PTA it may not have been possible without the possibility for it. The reason invoked is the role of the PTA as a commitment mechanism to prevent future governments from increasing protection.

Since Small has no tariff reductions to offer to Large, the LSPTA consists of a tariff reduction by Large on Small's exports in exchange for Small's cooperation in the provision of the public good. Consequently, the only direct effect of the LSPTA on trade is to increase Small's export price but not the quantity exported.[24] That is, no trade creation nor diversion takes place; there is only the transfer of tariff revenues from Large to Small.

We now determine the equilibrium domestic prices in Large and note that, in the presence of any trade, the remaining prices can be determined for any given tariff. Large sets a tariff τ^L on imports from Small and τ^{mfn} on imports from Large*. Given the pattern of trade, the domestic prices in each country relative to Large's consumer prices (which include the specific tariff) must follow the following arbitrage conditions:

Table 1: Prices relative to Large's after tariff price

Large	Small	Large*	Small*
p_l^L	$p_l^S = p_l^L - \tau^L$	$p_l^{L^*} = p_l^L - \tau^{mfn}$	
p_s^L		$p_s^{L^*} = p_s^L + \tau^{mfn^*}$	$p_s^{S^*} = p_s^L + \tau^{mfn^*} - \tau^{L^*}$

The equilibrium price for Large's import good, p_l^L, eliminates the sum of the world's excess demands which are given by $M_i^j \equiv H(d_i^j - 1)$ for j =Large, Large* and $M_i^j \equiv -H/k$ for j =Small, Small* if $p_i^j \geq 0$. The market clearing condition for good l is then given by:

$$M_l^L(p_l^L) + M_l^S(p_l^L - \tau^L) + M_l^{L^*}(p_l^L - \tau^{mfn}) = 0$$

A similar condition holds for good s. The market clearing conditions implicitly define the equilibrium prices as functions of the tariffs. Note that since small countries do not value the non-numeraire good any changes in the tariffs they face do not change their supply.[25] Therefore we have the following: $p_l^L(\tau^{mfn})$, $p_s^L(\tau^{mfn^*})$. It is then simple to show that an increase in Large's tariff on Large* raises the domestic price, $\partial p_l^L(\tau^{mfn})/\partial\tau^{mfn} \in (0,1)$, and an increase of the tariff by Large* lowers Large's export price, $\partial p_s^L(\tau^{mfn^*})/\partial\tau^{mfn^*} \in (-1,0)$.

Given this we can finally write the governments' objective functions, W^j, given by eq.(3) summed

[24] According to Gillson (p. 4,5) there is little evidence for the creation of trade due to GSP preferences. One of the studies he surveys concludes "that failure can be increasingly associated with supply-side constraints amongst the GSP beneficiaries." This is how we model Small's exports to Large.

[25] Assuming the post tariff price for Small's exporters is non-negative, which is the relevant case in equilibrium.

over the entire population, in terms of the policy variables. For Small we have:

$$\begin{aligned} W^S(\tau^L, e^S, \tau^{mfn}) &= H^S + W^{S\tau^L\tau^{mfn}} + W^{Se^S} \\ W^{S\tau^L\tau^{mfn}} &\equiv \frac{H^S}{k}(p_l^L(\tau^{mfn}) - \tau^L) \\ W^{Se^S} &\equiv -H^S e^S \end{aligned} \tag{4}$$

For Large we have:

$$\begin{aligned} W^L(\tau^L, e^S, \tau^{mfn}, \tau^{mfn^*}, e^L) &= H^L + W^{L\tau^{mfn^*}} + W^{L\tau^L\tau^{mfn}} + W^{Le^L} + W^{Le^S} \\ W^{L\tau^{mfn^*}} &\equiv H^L\{p_s^L(\tau^{mfn^*}) + \upsilon_S^L(p_s^L(\tau^{mfn^*}))\} \\ W^{L\tau^L\tau^{mfn}} &\equiv H^L\{p_l^L(\tau^{mfn}) + \upsilon_l^L(p_l^L(\tau^{mfn}))\} - \{M_l^S\tau^L + M_l^{L^*}\tau^{mfn}\} \\ W^{Le^L} &\equiv H^L\{\bar{\Psi}(b^L H^L e^L) - e^L\} \\ W^{Le^S} &\equiv H^L\alpha^L\bar{\Psi}(b^S H^S e^S) \end{aligned} \tag{5}$$

With these we can start the analysis of the LSPTAs.

3 Equilibrium analysis of LSPTAs

There exist two intra-block externalities. The first is the direct externality that arises through the public good. The second is the TOT externality due to Large's monopoly power in trade. Initially we assume that across the regional blocks only the TOT externality is present, relaxing this assumption will reinforce the results, as we show in a later section. These externalities are typically overcome through agreements that must be self-enforcing due to the absence of a supra-national authority to enforce them. In self-enforcing agreements governments agree to maintain cooperation on a particular policy for as long as the other government reciprocates such cooperative behavior. Otherwise, governments revert to non-cooperative behavior. We study such self-enforcing agreements in detail below. First we examine the non-cooperative Nash equilibrium within each regional block, both as a benchmark relative to the cooperative solution and as the last phase of the stage game that is repeated.

3.1 Non-cooperative solution

The Nash values for the tariffs on good l and the $e-$tax set by Large are defined by the FOC of eq.(5) given in the appendix and independent of each other since their effects on welfare are additive. The discriminatory tariffs that Large sets on Large* and Small are implicitly given by:

$$\tau^{Nmfn} = \frac{M^{L^*}}{M_p^{L^*}} \tag{6}$$

$$\tau^{NL} = p^L \tag{7}$$

The expression for τ^{Nmfn} bears the usual inverse relation to the excess demand of the exporting country, that is of the (net) excess demand from the other regional block. The tariff on Small, τ^{NL}, is the full price paid in Large. The reason is simple Small's offer is vertical so Large can extract all the producer surplus and leave the exporters in Small indifferent between exporting or not since there is no demand for the good in Small.[26]

As will be clear below it is also useful to consider the case when Large sets a non-discriminatory tariff on both its partners, $\tau^{mfn} = \tau^L$. In this case it will set:

$$\tau^N = \frac{M^S + M^{L^*}}{M_p^{L^*}} \tag{8}$$

As we would expect if Small did not export to Large then $\tau^N = \tau^{Nmfn}$. But otherwise, because $\tau^{NL} > \tau^{Nmfn}$, Large has an incentive to increase τ^N above τ^{Nmfn} to capture extra tariff revenue.[27] The following proposition relating the values of the different tariffs will be useful for later results:

Proposition 1 *(Discriminatory vs. MFN tariffs):*
Both Large's non-cooperative discriminatory tariff on Small, τ^{NL}, and its non-discriminatory tariff, τ^N, exceed the discriminatory tariff on Large, τ^{Nmfn} ($\tau^{NL}, \tau^N > \tau^{Nmfn}$). Moreover, Small exports all its endowment both under τ^{NL} and τ^N.*

Proof: Please see the appendix.

The basic reasoning is simple. The exporters in Large* must receive a strictly positive price and

[26] The results below go through if Small has a positive and sufficiently elastic demand for this good up to a maximum price $p^{S\max}$. In this case Small exports all its endowment under a discriminatory tariff $\tau^{NL} = p^L - p^{S\max}$. A tariff higher than this value would, if Small's offer is sufficiently elastic below $p^{S\max}$, lower Large's welfare.

[27] Note also that if there were no trade costs between large and small countries in opposite blocks and Large countries only have access to tariffs in their net export good, then no tariff discrimination may be possible so that in equilibrium all tariffs would be set at τ^N.

therefore if they face a tariff equal to the full price they would not export, this would not be an equilibrium. The non-discriminatory tariff, τ^N, is higher than the discriminatory tariff on Large*, τ^{Nmfn}, because of the incentive to capture revenues from Small's exports. If Large set its non-discriminatory tariff at τ^{Nmfn} then increasing it on Large* has no first order effect whereas raising it on the imports from Small has a strictly positive effect (since $\tau^{NL} > \tau^{Nmfn}$). Thus it is also clear that, if at $\tau^L = \tau^N$ Small did not export its endowment to Large then Large would be better off by lowering τ^N. Thus Small also exports its full endowment at the non-discriminatory tariff.

3.2 Bargaining solution to LSPTA

The non-cooperative outcome within each regional block is Pareto efficient for given MFN tariffs if there are no transfers and if countries are not able to exchange concessions across different policy areas. Clearly Large would benefit from an increase in Small's provision of the public good, but Small would be strictly worse off because it does not value it and would be forced to pay its cost. Similarly, a reduction in Large's tariff on Small would leave Small better off but only at the expense of a change in Large's welfare, in terms of lost tariff revenue. But, if exchanges can be made across the two issues, a Pareto improvement is possible. This is illustrated in figure 3 which depicts, on the vertical axis, the tariff set by Large on Small's imports, τ^L, for a given value of the MFN tariff, and Small's e-tax level, e^S, on the horizontal axis.

In figure 3, point N denotes the Nash value of the policies found above when tariffs are discriminatory. Large's iso-welfare contours, $\bar{W}^L$, represent higher levels of welfare along any given level of τ^L as we increase e^S until $\bar{e}$. Therefore, we implicitly define this value as the minimum e-tax required to satisfy $\arg\max_{E^S} W^L$. Note that, given our assumptions on the public good subutility, Large's iso-welfare line becomes vertical as e^S approaches zero.[28]

Small's iso-welfare contours are denoted by $\bar{W}^S$. Starting at N Small's welfare increases as τ^L is lowered, reaching a maximum at the origin.[29] Point $\hat{e}^S$ denotes the maximum $e-$tax that maintains Small at the Nash welfare level. The slope of Small's iso-welfare lines is negative, constant and equal to $-k$ (the ratio of Large to Small's endowments). Since at τ^{NL} Small finds it optimal to export all its endowment a reduction in τ^L by an amount k translates into an increase of k in the price that Small receives for its exports. This means that Small now receives an extra $-kM_l^S = H^S$ for its exports. Since H^S is precisely the aggregate cost for Small of increasing its e-tax on each individual by one unit, the slope of the iso-welfare is $-k$.

[28] Its slope is $-W^L_{e^S}/W^L_{\tau^L}$.
[29] We rule out import subsidies.

The efficiency locus once we allow for trade-offs between the policies is depicted in figure 4. These are the combinations of τ^L, e^S that are Pareto efficient for different threat tariffs, τ^T, up to the highest credible threat under discriminatory tariffs, τ^{NL}. If Large's iso-welfare curves are steeper than Small's at $\hat{e}^S$ then the efficiency locus is the segment $0\hat{e}^S$ otherwise the locus is $0CC'$, as depicted. The segment CC' is vertical because, at a given e, increases in the threat point yield the same slope for Large's iso-welfare. This implies that the increase in the threat point is passed on as a higher PTA tariff at given e.[30]

Before addressing the enforcement issue we analyze the bargaining outcome for LSPTAs in a static setting implicitly assuming that it can be enforced.[31] This allows us to understand the different forces at play and will make clear why, in the presence of large asymmetries in bargaining power, enforcement is of paramount importance. To provide some insight about the determinants of the outcome under LSPTAs we first define the following critical values.

We say that **Large's weight on public good consumption, λ^L, is sufficiently high** or **the degree of the cross-order effect, α^L, is sufficiently high if** $g^L \geq \bar{g}$ where $g = \lambda^L$ or α^L and $\bar{g}$ is defined by $\{\frac{W^L_{e^S}(\bar{g})}{W^L_{\tau^L}} = \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}\}|_{\tau^L=0,e^S=\hat{e}}$.[32] With this definition we can state the following proposition.

Proposition 2 *(Static LSPTA bargaining solution):*
Any Pareto efficient bargaining process which uses credible threats to form a (static) LSPTA requires Large to extend a duty-free tariff to Small if either Large's weight on public good consumption, λ^L, or the degree of the cross-border effect, α^L, are sufficiently high.

Proof: Please see the appendix.

Obviously the exact bargaining solution along the Pareto efficient frontier $0\hat{e}^S$ (or $0CC'$) depends on the particular (efficient) bargaining concept used and the relative bargaining power of countries. We are interested in the extreme case where Large has all the bargaining power. This is an important case empirically given the extreme size asymmetries in recent LSPTAs and because we want to answer

[30] Obviously, if there was no cross-border effect, i.e. if $\alpha^L = 0$, then Large's iso-welfare contours would be independent of e^S. Then, the only efficient point (in the absence of transfers) is the Nash.

[31] Abrego et. al (1997) compute the Nash bargaining solution to a similar problem using a global numerical simulation model.

[32] This requires $\lambda^L\alpha^L > \frac{-W^L_{\tau^L}/W^S_{\tau^L}}{\delta^S H^L b^S \Psi'(b^S H^S e^S)}|_{\tau^L=0,e^S=\tilde{e}}$. When Small is on the inelastic portion of its export supply then changes in τ^L lead to a pure transfer so that $-W^L_{\tau^L}/W^S_{\tau^L} = 1$. Note also that when $e^S \to 0$ the RHS approaches zero in this inequality. The factor $\frac{1}{\delta^S} > 1$ with $\delta^S \in (0,\ 1)$ (this is Small's discount factor that plays a role later in the analysis).

whether even in such asymmetric bargaining situations Small can be strictly better off than if no such LSPTA were possible.[33] If Large has all the bargaining power and it can make a take-it-or-leave-it (TOL) offer, the solution to the static LSPTA would be at $\hat{e}^S$ (or C' in the case depicted in figure 4) because large can extract all the bargaining gains from Small and leave it at the Nash welfare level, i.e. on a point along $\bar{W}^{NS}$ in figure 3.

The highest credible threat Large can make in the static game under discriminatory tariffs is τ^{NL}. If Large must use non-discriminatory tariffs then its highest credible threat is τ^N, given by eq.(8). Since, as we show in proposition 1, both tariffs lead Small to export its full endowment, the analysis above carries through under non-discriminatory tariffs if we use τ^N instead of τ^{NL} as the threat point.

3.3 Self-enforcing bargaining solution to LSPTA

Much like other international cooperative agreements, LSPTAs must be self-enforcing given the absence of a supra-national authority to punish a country if it does not implement the bargained solution. Therefore, LSPTAs are subject to incentive constraints which balance the gains of deviating from the agreement against the ensuing losses from retaliation. If the asymmetry in bargaining power is such that it allows Large to make a TOL offer then enforcement becomes a key issue. Intuitively the reason for this is that if a static game, such as the one above, were repeated Small would always cheat and set $e^S = 0$ since it gains nothing from cooperation.

Cooperative self-enforcing agreements are well characterized by certain repeated games.[34] We are interested in analyzing the self-enforcing bargaining solution to the LSPTA when Large makes a TOL offer to Small for given MFN tariffs. We assume that each government observes the other governments actions, a, at the end of each period t and thus a pure strategy at time t, s_t, for each government is a sequence of maps from all possible histories of play $h_t(a_0, \ ..., \ a_{t-1})$ to the action space, A of tariffs and e-taxes. We focus on stationary Nash equilibria and require that they be

[33] This point is made in the recent World Bank report on regionalism, after discussing the accession policies in the context of NAFTA and the EU it states that:

> "In practice, what we are seeing here is essentially that any country is free to apply; but the price of entry is set separately for each entrant. This can lead to asymmetric agreements in which benefits to developing country candidates are reduced and possibly appropriated by existing members through side conditions on issues such as the environment, labor regulations, and rules of origin." (2000, p.100)

[34] In the context of tariff setting self-enforcing agreements have been represented as repeated games first by Jensen and Thursby (1983) in finite time and extended by Dixit (1987) to infinitely repeated game where cooperative tariffs are sustained by the threat of Nash reversion. More recently this framework has been used to study trade agreements (Bagwell and Staiger, 1990 and Riezman, 1991).

subgame perfect. We adopt the simplest trigger strategies that maintain such equilibria– infinite Nash reversion. That is, Small reverts to $e^S = 0$ and Large to τ^{NL} (or τ^{mfn} if the threat tariff is constrained to be no higher than the MFN tariff as we discuss below). The payoffs for each country are given by their respective welfare functions, W^j, discounted at the rates $\delta^j = \overline{\delta}^j \rho$ where $\overline{\delta}^j$ reflects a proper discount factor and ρ the probability that the game continues for one more period. For now we do not put any restrictions on the relative size of the discount factors.[35]

More formally, each period Large makes a TOL offer to Small that specifies a cooperative level of τ^L and e^S for given levels of τ^{mfn}, τ^{mfn^*} and e^L.[36] The self-enforcing TOL offer maximizes the present discounted value of Large's welfare subject to two incentive constraints, IC^j, one for each country, and to a participation constraint for Small. However, this last constraint is redundant because it is implied by the incentive constraint for Small. Since we focus on stationary strategies, maximizing the present discounted value is equivalent to maximizing welfare period by period. Therefore, the self-enforcing bargaining solution tariff and e-tax to the LSPTA, for given MFN tariffs, is Φ^{LSPTA} given by:

$$\Phi^{LSPTA} = \underset{\tau^{cL}, e^{cS}}{\arg\max} \{W^L(\tau^{cL}, e^{cS}, \tau^{mfn}, \tau^{mfn^*}, e^{NL}) : IC^{j=L,S}\}$$

The incentive constraints, IC^j, require that, for each country, the net gain from deviating in any one period, Ω^j, must not exceed the discounted value of the net benefit from future cooperation, $\frac{\delta^j}{1-\delta^j}\omega^j$. Where $\omega^j \equiv W^{jC} - W^{jN}$ and $\Omega^j \equiv W^{jD} - W^{jC}$. More specifically:

$$\omega^S(\tau^{cL}, e^{cS}, \tau^{mfn}) = W^{S\tau^{cL}\tau^{mfn}} + W^{Se^{cS}} - (W^{S\tau^{NL}\tau^{mfn}} + W^{Se^{NS}}) \quad (9)$$

$$\omega^L(\tau^{cL}, e^{cS}, \tau^{mfn}) = W^{L\tau^{cL}\tau^{mfn}} + W^{Le^{cS}} - (W^{L\tau^{NL}\tau^{mfn}} + W^{Le^{NS}}) \quad (10)$$

$$\Omega^S(e^{cS}) = W^{Se^{NS}} - W^{Se^{cS}} \quad (11)$$

$$\Omega^L(\tau^{cL}, \tau^{mfn}) = W^{L\tau^{NL}\tau^{mfn}} - W^{L\tau^{cL}\tau^{mfn}} \quad (12)$$

The solution to the LSPTA problem is as follows. Large's objective function is obviously unchanged relative to the static problem. However, it is now subject to its own and Small's IC. Small's IC is more stringent than the participation constraint required in the static LSPTA problem, as long

[35] Note that when $\delta^L \neq \delta^S$ there is a motive for intertemporal substitution (if $\delta^L > \delta^S$ the incentive is to have Small's payoffs being relatively larger initially and the opposite for Large). This suggests that it would be optimal to focus on non-stationary strategies. However, simple non-stationary strategies involving first more cooperation by Large until some period t, and then by Small would not be optimal for Large. The reason is that, seen from period t, the policies must still be self-enforcing. If they are indeed self-enforcing then Large should have proposed those policies at the start and not at t because nothing is different at t (except for the history of play). So we focus on stationary strategies.

[36] The latter has no effect on the solution given the separability of the welfare function and the fact that Small does not value the public good.

as Small discounts the future. Recall that the participation constraint simply requires that $\omega^S \geq 0$ and it holds with equality when Large makes a TOL in the case of the static LSPTA. However, if Small does not gain from cooperating then the only self-enforcing e-tax it can set is zero. Otherwise, it will gain by deviating from the agreement. Therefore, not surprisingly, the self-enforcing solution entails less cooperation from Small for any given tariff threat.

In figure 5a, $\overline{IC}^j$ represents the iso-incentive constraint (iso-IC) for country j, that is the combinations of τ^L and e^S that leave country j indifferent between cooperating and deviating. As we just argued, Small's iso-incentive constraint must be interior to its iso-welfare line at the Nash level, $\bar{W}^{NS}$, except at N. It is simple to show that the slope of the iso-IC for Small is given by $-k/\delta^S$. The iso-IC for Large holds with equality at $\tau^L{=}\tau^{NL}$ and has a negative slope of $-\delta^L W_e^L/W_\tau^L$, flatter than the slope of its iso-welfare curves.[37]

We illustrate the possible LSPTA solutions in figure 5. Since Large makes a TOL offer, Small's IC must bind at any solution, otherwise Large would offer a higher tariff or demand a higher e^S. Large's IC however may not bind if it is sufficiently patient. To discuss the different solutions it is helpful to define the following critical point. We say that **Large is sufficiently patient** if $\overline{IC}^L$ intersects $\overline{IC}^S$ at or below $\tau^L = 0$ when the threat point is the Nash, that is if $\delta^L \geq \bar{\delta}^L$ where $\bar{\delta}^L$ is defined implicitly by $\Omega^L(\tau^L = 0, e^S(\tau^{NL})) = \frac{\bar{\delta}^L}{1-\bar{\delta}^L}\omega^L(\tau^L = 0, e^S(\tau^{NL}))$. In this case, if either Large's weight on the public good consumption, λ^L, or the degree of the cross-border effect, α^L, are sufficiently high, then the duty-free solution is at the intersection of $\overline{IC}^S$ with horizontal axis in figure 5a. If neither λ^L nor α^L are sufficiently high the interior solution results and it is found by equating the MRS of the policies in Large's welfare with the MRS of the policies in enforcement for Small as illustrated by point BI in figure 5a. If Large is not sufficiently patient then, if its IC binds, the solution is given by point BII the intersection of $\overline{IC}^L$ and $\overline{IC}^S$ in figure 5b. Otherwise, it is again given by equating the MRS of the policies in Large's welfare and Small's enforcement (as represented by point BI).

The proposition below summarizes the possible solutions.

Proposition 3 *(Self-enforcing LSPTA bargaining solution):*

The self-enforcing LSPTA (TOL) bargaining solution when the threat is $\tau^T = \tau^{NL}$ *is* $e^B = \frac{\delta^S}{k}(\tau^{NL} - \tau^B)$ *and the preferential tariff* τ^B *is:*

$\tau^B = 0$ *iff:*

i. Large is sufficiently patient and

[37] Notice also that $\overline{IC}^L$ intersects $\overline{IC}^S$ at most twice, once when $e^S = 0$ and a second time from below because $\Psi'' < 0$.

ii. Large's weight on the public good consumption, λ^L, or the degree of the cross-border effect, α^L, are sufficiently high.

Otherwise τ^B is:

$\tau^{BI}: \frac{W^L_{e^S}(e^B)}{W^L_{\tau^L}} = \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$ *(IC^L does not bind)*

$\tau^{BII}: \tau^{NL} - \tau^B = \frac{\delta^L k}{H^S} H^L \alpha^L \bar{\Psi}(b^S H^S e^B)$ *when* $\frac{W^L_{e^S}(e^B)}{W^L_{\tau^L}} \geq \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$ *(IC^L binds)*

Proof: Please see the appendix.

Having established the solution to the LSPTA we note its welfare impact on its members.

Proposition 4 *(Welfare impact of LSPTAs given MFN tariffs):*
For given MFN tariffs, $\delta^S \in (0,1)$ and $\delta^L \in (0,1)$, a self-enforcing LSPTA is always strictly Pareto improving for both partners relative to no LSPTA even if Large has all the bargaining power and makes a TOL offer to Small.

Proof: Please see the appendix.

It is obvious that there is a potentially Pareto improving zone, as we first show in figure 3, and that if Large can make a TOL offer it can pick a point in the shaded region in that figure. What was not obvious then was that the self-enforcement constraint ensures that Small is also strictly better off under the LSPTA if it discounts the future at all. This is important because it ensures that Small never refuses Large's proposal for a LSPTA. Thus, if the multilateral trade regime allows LSPTAs, it is reasonable to focus on the self-enforcing solution to the LSPTA problem during the negotiation of the MFN tariffs.

Up to now we have allowed Large to set discriminatory tariffs on the different sources of its imports. However, one of the most important multilateral trading rules in GATT is that of non-discrimination or MFN treatment. According to the **most-favoured nation rule (MFN)** Large must extend the same tariffs to both partners. If this rule is strictly enforced then no preferential tariffs can be given to Small and therefore (strictly) welfare improving LSPTAs are not possible. As we discuss in the introduction, currently GATT rules allow exceptions to MFN. Since the upper bound tariff is still tied to the MFN value a **LSPTA exception to MFN** entails $\tau^L \leq \tau^{mfn}$.[38] The analysis above also applies to this case if we use the MFN tariff as the threat point. Therefore, when setting the MFN tariff Large takes into account its effect as the threat point at the LSPTA. In the

[38] At least during periods of cooperation between large countries.

following proposition we establish the relative welfare impact on Large of an exogenous reduction in MFN tariffs under a LSPTA exception and strict MFN enforcement.

Proposition 5 *(Costs of MFN tariff reductions under a LSPTA exception)*
Large's welfare gains from an exogenous and reciprocal MFN tariff reduction are lower under a LSPTA exception to MFN than under strict MFN if the LSPTA after the MFN reduction is duty-free because such a reduction either:

i. lowers Small's public good provision, e^B, if the initial LSPTA is duty-free, or

ii. lowers the preferential tariff until the MFN tariff, τ^{mfn}, is sufficiently low to induce a duty-free LSPTA and then lowers e^B. Moreover such a $\tau^{mfn} > 0$ always exists.

Proof: Please see the appendix.

The intuition is that an MFN reduction reduces the threat Large can use against Small. Therefore Small's gain from cooperation through the LSPTA falls since it has less to loose from not cooperating. Since Small's gain from deviating remains unchanged the self-enforcing value of public good provision in Small falls. To ensure that Small's IC holds at the new threat point Large must therefore either lower the preferential tariff or accept a lower e^S. If initially the LSPTA was duty-free, as illustrated in figure 6, with $\tau^{T'}$ as the initial threat point, then with the lower threat, $\tau^{T''}$, Large cannot offer any lower preferential tariffs and therefore must accept the lower self-enforcing value $e^{B''}$. Since at a duty-free LSPTA Large's marginal rate of substitution of τ^L for e^S in welfare is higher than the MRS of these policies in enforcement for Small, Large would prefer to pass the reductions in the threat as tariff cuts, which is what happens when LSPTAs are not possible. But, since it cannot cut the preferential tariff, the MFN reduction leaves it relatively worse off.

When the initial LSPTA is not duty-free then Large can choose a cheaper way to make IC^S hold, viz. lowering the preferential tariff as shown in figure 6 when the threat point moves from τ^T to $\tau^{T'}$. However, this has the same cost with or without a LSPTA exception, so there is no extra cost to doing so under the LSPTA exception regime. But, at a low enough MFN tariff, $\tau^{T'}$, the LSPTA becomes duty-free and a reduction in e^B must again take place. The decrease in Large's bargaining power due to its lower tariff threat, and the resulting lower e-tax in Small, explains why Large benefits relatively less when LSPTAs are possible from a sufficiently large MFN tariff reduction.

We now model the decision to undertake multilateral liberalization and the choice of multilateral rules regarding the possibility to form LSPTAs. This allows us to determine if LSPTAs are a stumbling block to MTL.

4 Multilateral trade liberalization

The LSPTAs which we model have taken place in the context of a broader process of multilateral trade liberalization. In practice much of the multilateral liberalization that takes place has followed the principal supplier rule. That is, if country A is the biggest exporter to B of a given product then B proposes a tariff reduction to A on that product in exchange for A's reduction in a tariff on one (or several) of the products it imports from B. Once these concessions are negotiated they are extended to the remaining members of the GATT/WTO through MFN. So, because of MFN, countries A and B commit to binding their maximum tariffs on imports from other countries at the level negotiated between themselves. It is the effect of binding the maximum tariff in this way, and therefore "tying one's hands" in terms of the maximum threat that can be used in a LSPTA, which we now address.

More specifically, the question we answer in this section is: which set of rules or regime regarding MFN (and therefore LSPTAs) leads to the lowest multilateral tariff? Or: are LSPTA exceptions a building block or a stumbling block towards further MTL?

4.1 Enforcement under alternative MFN regimes

Bilateral or regional agreements are typically "easier" to reach than multilateral ones.[39] We do not model negotiation or bargaining costs explicitly but assume them implicitly. What this assumption then implies is that even after a multilateral trade negotiation takes place a country can sign a LSPTA. The possibility for countries to sign LSPTAs at any point means that such agreements should be viewed as the last stage of the game that takes place each period. So, large countries cannot commit to a level of the tariff set on their Small partner during the MTN. As illustrated in figure 1, the first stage involves the choice of LSPTA rules and whether or not to pursue MTL. Given the choice of those rules, the second stage involves the choice of MFN tariff levels. This is the three-stage game that takes place each period and is indefinitely repeated.

A common complaint from developing countries is that most GATT rules have been decided by developed countries without much input from small countries.[40] To capture this we assume that Large and Large* choose the trading rules in the first stage to maximize the present discounted value of their own joint welfare. Therefore, in the next section, we calculate and compare the payoffs for the large countries under each of the alternative regimes we consider.

[39] Compare for example the number of trade rounds in the last 20 years, one, with the number of preferential agreements signed by either the EU or the U.S. in the same period.

[40] See for example Srinivasan (1999).

We model MTL as the self-enforcing solution to a repeated game. Large countries choose a cooperative level of their MFN tariffs that maximizes their joint welfare subject to incentive constraints that ensure neither prefers to deviate from the agreement today and be punished. We focus on subgame perfect Nash equilibria sustained by trigger strategies that involve infinite Nash reversion. The exact trigger depends on whether governments choose to have an LSPTA exception to the MFN rule or not and if not on the degree of commitment by large countries to enforce the MFN rule and therefore to sign LSPTAs during trade wars. We consider three regimes, the status quo which, as we describe above, involves a LSPTA exception to the MFN rule and two different degrees of commitment to MFN: weak and strong. A strong commitment to MFN requires large countries to always set non-discriminatory tariffs whereas a weak commitment entails non-discriminatory tariffs only while large countries are cooperating on the bilateral tariffs between them but not during a trade war. We describe these in more detail below. The different regimes lead to different incentive constraints for the MTL process and therefore to different levels of multilateral trade liberalization.[41]

Let us first analyze the incentives to cooperate under the LSPTA exception to MFN currently in place. As we describe in the previous section this exception still binds large countries' maximum tariffs to the MFN value agreed to multilaterally during periods of cooperation. Therefore, the maximum tariffs Large can offer in the LSPTAs (and therefore the maximum credible threat it can make) is no higher than the multilaterally agreed MFN tariff. The trigger strategies are such that cooperation in MFN tariffs is conditional on cooperation in those tariffs in previous periods against the large partners, i.e. $\tau^{mfn} = \tau^{mfn^*} = \tau^c$, *and* a tariff against the Small partner that is no higher than the MFN value agreed multilaterally $\tau^L \leq \tau^c$. This implies that the highest credible threat Large can make to Small without incurring punishment form Large* is τ^c. But, when there is no cooperation in MFN tariffs, governments are free to set discriminatory tariffs and threaten Small with τ^{NL}. So, with the LSPTA exception to MFN, the gains from cooperation and deviation for Large (and Large*

[41] We do not attempt to model why, when there are only two large countries, they choose to enforce an MFN rule vis-a-vis Small countries in the first place. We just take this feature of the trading system as given. As Horn and Mavroidis (p.37) point out in their review of theoretical models of MFN: "a major weakness with the literature is the fact that there does not appear to exist models where MFN is an endogenous feature of an agreement." See the discussion in Jackson (1997, chapter 6) on the origins and arguments for and against the use of MFN. See also Ghosh et. al (1998) for numerical simulation results on the value of MFN for developing countries.

due to the symmetry) are given respectively by:

$$\begin{aligned}
\omega^{NC}(\tau^B(\tau^c), e^B(\tau^c), \tau^c) &= W^{L\tau^L=\tau^B(\tau^c),\tau^{mfn}=\tau^c} + W^{L\tau^{mfn^*}=\tau^c} + W^{Le^S=e^B(\tau^c)} \\
&\quad -(W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} + W^{L\tau^{mfn^*}=\tau^{Nmfn}} + W^{Le^S=e^B(\tau^{NL})}) \\
\Omega^{NC}(\tau^B(\tau^c), e^B(\tau^c), \tau^c) &= W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} + W^{Le^S=e^B(\tau^{NL})} \\
&\quad -(W^{L\tau^L=\tau^B(\tau^c),\tau^{mfn}=\tau^c} + W^{Le^S=e^B(\tau^c)})
\end{aligned}$$

As usual ω^{NC} represents the difference between the payoffs in periods of cooperation and punishment and Ω^{NC} the difference between the deviation and cooperation payoffs. Under cooperation Large sets $\tau^{mfn} = \tau^c$ on the other large country and signs a LSPTA with Small using τ^c as the threat point. Notice that, as we first describe in proposition 5, the choice of cooperative tariff affects the payoffs indirectly by changing the threat point in the LSPTA to τ^c and therefore the actual tariff that is set on the Small country is $\tau^L = \tau^B(\tau^c)$ and $e^B(\tau^c)$, the solution described in proposition 3.

Under **weak commitment to MFN** if either large country sets discriminatory tariffs during a period of cooperation in MFN tariffs then, in the following period, large countries revert to Nash behavior in multilateral tariffs. But, as was the case with the LSPTA exception, when there is no cooperation in MFN tariffs, governments are free to set discriminatory tariffs, and therefore sign LSPTAs with τ^{NL} as a threat. For this scheme to be self-enforcing the governments' trigger strategies differ from those under the LSPTA exception in only one dimension. Large countries are punished if they set $\tau^L \neq \tau^{mfn}$ during a cooperation period whereas under the exception they would only get punished if they set $\tau^L > \tau^{mfn}$ during a phase of cooperation. So, under weak commitment, the gains from cooperation and deviation are given respectively by:

$$\begin{aligned}
\omega^{WC}(\tau^B(\tau^{NL}), e^B(\tau^{NL}), \tau^c) &= W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c} + W^{L\tau^{mfn^*}=\tau^c} + W^{Le^s=0} \\
&\quad -(W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} + W^{L\tau^{mfn^*}=\tau^{Nmfn}} + W^{Le^S=e^B(\tau^{NL})}) \\
\Omega^{WC}(\tau^B(\tau^{NL}), e^B(\tau^{NL}), \tau^c) &= W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} + W^{Le^S=e^B(\tau^{NL})} \\
&\quad -(W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c} + W^{Le^s=0})
\end{aligned}$$

Under weak commitment a deviation in either the multilateral tariff or in the tariff set on the small partner triggers Nash reversion by the Large countries. Therefore if Large were to deviate in either it would find it *optimal* to deviate in both.[42] Thus, under deviation and Nash the policies are

[42] To see this suppose that today Large deviates on only one of the policies. In the following period the large countries revert to Nash behavior and therefore, the continuation payoffs are the same as if Large had deviated in both policies.

$\tau^{mfn} = \tau^{Nmfn}$, $\tau^L = \tau^B(\tau^{NL})$, $e^B(\tau^{NL})$.

The second alternative to a LSPTA exception is (strong) commitment to MFN. Under **(strong) commitment to MFN** governments set a non-discriminatory tariff at all times and therefore cannot pursue LSPTAs. For this commitment to be credible in the model we have described, where governments always have *access* to discriminatory tariffs, we require a trigger strategy similar to the one under weak commitment plus an extra instrument for governments to punish each other when they are off the equilibrium path in their MFN tariffs. Such an instrument would ensure that governments would not find it optimal to use discriminatory tariffs and strike a LSPTA, even after deviating from the MTL agreement. Below we further elaborate on possible mechanisms to achieve this. One possibility is to replace infinite Nash reversion with temporary punishments. We can then have a longer punishment period when countries deviate from the MFN tariff and form LSPTAs then when they deviate but do not form LSPTAs. We do not model these alternative strategies here but instead assume that governments do not have access to discriminatory tariffs, therefore they can only set one tariff on both partners. The trigger strategy in this modified model is to set the non-discriminatory tariff at the cooperative level if that was the history of play in the previous period for both large countries and otherwise revert to the Nash value, τ^N, given by eq.(8). Under strong commitment the gains from cooperation and deviation for Large are then respectively given by:

$$\begin{aligned}
\omega^C(\tau^c) &= W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c} + W^{L\tau^{mfn*}=\tau^c} - (W^{L\tau^{mfn*}=\tau^N} + W^{L\tau^L=\tau^N,\tau^{mfn}=\tau^N}) \\
\Omega^C(\tau^c) &= W^{L\tau^L=\tau^N,\tau^{mfn}=\tau^N} - W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c}
\end{aligned}$$

4.2 LSPTAs: stumbling or building block for MTL?

We can now answer the question of this section. Are LSPTA exceptions a building block or a stumbling block towards further multilateral trade liberalization? That is to say is the lowest self-enforcing tariff under LSPTA higher or lower than under strong or weak commitment? As we show in figure 7 we are looking for the lowest tariff at which the MTL incentive constraint holds. For the gain from deviation and cooperation to intersect at most once for tariffs below the Nash they must be respectively convex and concave with respect to the cooperative MFN tariff. It is simple to show that these conditions hold for all three regimes when excess demands are linear in prices.[43]

However, Large would have foregone the one time gain from deviating in the other policy.

[43] For the convexity of Ω under commitment and weak commitment we make use of the fact that the price effect on Large of changing τ^{mfn} does not exceed one. For the concavity of ω we also make use of the symmetry in the excess demand functions $M_l^L = M_s^{L^*}, M_s^L = M_l^{L^*}$. For the LSPTA exception case we also make use of the fact that Ψ is concave.

Therefore we define the **most cooperative tariff**, τ^k, as the lowest tariff that is self-enforcing under regime $k = C, WC, NC$:

$$\Omega^k(\tau^k, .) = \frac{\delta^L}{1-\delta^L}\omega^k(\tau^k, .)$$

We are interested in situations where multilateral trade negotiations yield lower multilateral tariffs so we require Large's discount factor to be sufficiently large that the lowest self-enforcing multilateral tariff under the LSPTA exception is lower than τ^{Nmfn}.[44]

Allowing a LSPTA exception to MFN is a **stumbling (building) block** to multilateral trade liberalization (MTL) if the most cooperative tariff that can be achieved under such an exception is higher (lower) than the most cooperative tariff under a regime where no such exceptions are allowed. With this we can state:

Proposition 6 *(LSPTAs as stumbling or building blocks)*

A LSPTA exception to MFN is:

i. a stumbling block to MTL relative to a strong commitment to MFN

ii. a building block to MTL relative to a weak commitment to MFN.

Proof: Please see the appendix

The intuition is the following. If there is a strong commitment to MFN then LSPTAs are effectively ruled out. Allowing a LSPTA exception increases the gains from deviating and lowers the gains from cooperating in the multilateral agreement because of the temptation to set discriminatory tariffs and propose a LSPTA to Small. More specifically the most-cooperative tariff under the LSTPA exception is higher for either or a combination of the following two reasons. First if the LSPTA is not duty-free during periods of cooperation between large countries (and therefore during trade wars) then the cost of lowering the MFN tariff is identical under the exception and strong commitment regime (proposition 5). However, the stumbling block result still holds because the possibility to use discriminatory tariffs under the LSPTA lowers the cost of trade wars between large countries, both due to the ability to discriminate and the fact that its multilateral tariff during trade wars is lower than under strong commitment ($\tau^{NL} < \tau^N$). An extra effect is present if the LSPTA is duty-free during trade wars between large countries (and therefore during periods of cooperation) : a

[44] Otherwise we would have to deal with the possibility that τ^{Nmfn} is the only incentive compatible tariff under the different regimes.

reduction of the MFN tariff is relatively more costly under the LSPTA. This is the effect we discuss in proposition 5.

When governments of large countries have a weak commitment to MFN the gain from cooperating is lower and the gain from deviating higher relative to the LSPTA exception case. Whereas deviating under the LSPTA exception allows large countries to increase their gains from the LSPTA by using a bigger threat, τ^{NL} instead of τ^{c}, deviating under weak commitment leads to an even larger gain because initially there was no LSPTA at all. For a similar reason the gains from cooperation are lower under weak commitment.[45]

This result shows that governments must be extremely careful when deciding whether to enforce MFN multilaterally. If they do not have enough instruments to enforce compliance with MFN in periods of trade wars this weak commitment leads to higher multilateral tariffs relative to the LSPTA exceptions currently allowed in the GATT. On the other hand, if they can credibly sustain a strong commitment then lower MFN tariffs are sustainable.

The result raises a number of questions which we now address. What is the effect of "deepening" regional integration on multilateral tariffs? Does the result hold if the public good has global spillovers? Which regime is preferred by large and small countries?

5 Extensions

5.1 Deepening LSPTAs and MTL

We now show that the stumbling effect, the difference between multilateral tariffs under a LSPTA exception and a commitment regime, can be sizable if the weight that large countries place on the public good, or its cross-border effect is high. For a given tariff threat in the LSPTA, an increase in either of those two parameters deepens the LSPTA, that is it lowers the preferential tariff and/or increases Small's public good provision, if and only if the initial LSPTA is not duty-free.[46] Therefore the following result predicts that if the initial LSPTA, during a period of cooperation between large countries, is duty-free then increases in α^{L} or λ^{L} deepen the LSPTA by increasing the threat point, which is the multilateral tariff.[47]

[45] The two incentive constraints are identical only if no cooperation were possible under the LSPTA, for example if Small did not value the future.

[46] This is simple to show using the solution to the LSPTA in proposition 3.

[47] Bond, Syropoulos and Winters (2001) analyze the effect of a reduction in a customs union's internal tariff on its external one. They show that, for elasticities of consumption no greater than one, if the exogenous reduction of the internal tariff (which is assumed to be binding) is accompanied by a sufficiently large external tariff *reduction* (which must be self-enforcing) then the initial tariff set by the rest of the world on the customs union remains self-enforcing.

Proposition 7 *(Effect of deepening LSPTA)*

If the initial LSPTA is duty-free then increases in the weight Large places on the public good or its cross-border effect will increase:

i. Small's provision of the public good

ii. the multilateral tariff, τ^{NC}, and

iii. the stumbling block effect, $\tau^{NC} - \tau^{C}$.

Proof: Please see the appendix.

First note that, since no preferential arrangement takes place under commitment, the multilateral tariff under this regime is independent of the importance of the public good. Under the LSPTA however, τ^{NC} is proportional to the weight attached to the public good if the initial LSPTA is duty-free for the following reason. At the initial tariff threat, τ^{NC}, Small has no incentive to change its supply of the public good after an increase in λ^{L}, since it already faces a zero tariff. However, for Large, this extra weight implies a higher marginal benefit from increases in Small's public good supply, which can only be achieved with a higher threat tariff. Consequently, at the initial multilateral tariff, large countries will have a higher incentive to deviate and a lower incentive to cooperate, so it is no longer self-enforcing. Large countries need a higher multilateral tariff to use as a threat to extract the increased gains from the LSPTA. The same argument holds for the scope of the cross-border effect.[48]

The last proposition is particularly important if the scope and weight placed on the public good are increasing. We believe that is the case since the view that certain policies have only a domestic effect is increasingly challenged. One reason for this, in the case of environmental issues, is the increase in scientific knowledge regarding the interdependence of ecosystems. The increase of the weight placed on the public good is likely to be a consequence of development as long as it is a normal good.

Therefore, a testable prediction from this model is that, given the growing acknowledgement and importance of public goods with regional spillovers, we should observe higher multilateral tariffs in

Theirs is a pure trade model and the results are driven by trade diversion. The fact that the prediction is the opposite of the one in our paper clearly shows the importance of modelling LSPTAs.

[48] The gains that Large can extract from the LSPTA also increase as Small becomes more patient. Therefore, it is simple to derive a proposition similar to proposition 7 to show when increases in Small's discount factor lead to higher multilateral tariffs. The extra condition required is that the public good sub-utility function, Ψ, is not too concave to ensure that the increases in e^{S} resulting from the higher discount factor have a sufficiently higher marginal benefit. A similar condition is required to show that proposition 7 may also hold for LSPTAs which are not duty-free. Therefore, the condition in the proposition is sufficient but not necessary. Note also that it is simple to characterize the conditions under which the initial LSPTA is duty-free in terms of the exogenous parameters, e.g. if α^{L}, λ^{L} are sufficiently high to both satisfy the definition previously provided and also ensure that $\delta^{L} > \bar{\delta}^{L}$. Recall that $\bar{\delta}^{L}$ is defined as the critical value that ensures Large's IC in the LSPTA does not bind, it is a negative function of α^{L}, λ^{L}.

the goods imported from a regional partner after LSPTAs are formed. Alternatively, if we modelled an exogenous process of gradual MTL, the result would be that under the LSPTA there is a slower liberalization of multilateral tariffs in those goods.

We now show that this and previous results also hold if the public good has global spillovers.

5.2 Public goods with global spillovers

Although the spillovers for some of the issues discussed for linkage in the context of the WTO are relatively stronger at the regional level, many of the issues have global effects, e.g. global warming or "psychological" costs due to "poor" enforcement of human or core workers' rights. To evaluate the effect of dealing with such issues outside the WTO we now show that the results derived are also valid if the spillovers are global.

Small countries do not value the public good and therefore their welfare functions are unchanged. The original welfare function for Large, W^L, must now reflect the spillover arising from the countries in the other trade block.

$$\hat{W}^L = W^L + W^{Le^{L^*}} + W^{Le^{S^*}}$$

Where $W^{Le^j} = H^L \alpha^L \bar{\Psi}(b^j H^j e^j)$.

The non-cooperative tariffs derived in section 3 are unchanged given the additive separability of $\hat{W}^L$. The solution to the LSPTA with the regional partner is also unchanged since it takes the other block's actions as given. Moreover, a large country cannot offer tariff reductions and form a LSPTA with the small country in the opposite block, since they do not trade with each other. Therefore the results in section 3 continue to hold in the presence of global spillovers.[49]

We are interested on the impact of LSPTAs on multilateral tariffs when linking trade and non-trade policies is not allowed in the WTO, that is linking is not allowed during the MTL stage of our model. Therefore, the trigger strategies that enforce cooperation in multilateral tariffs must be independent of whether large countries cooperate with each other in the provision of the public good. Moreover, since the externality enters additively in welfare, the equilibrium level of the multilateral tariffs will also be independent of whether large countries enter into a separate self-enforcing agreement *with each other* to address the non trade issue.[50]

[49] Even if we rule out international lump-sum transfers there is still one offer that Large can make to Small* to extract cooperation in the public good. Large could offer to impose a higher tariff on the good it imports from Large*. Small* is then better off since it faces a lower price for the good it imports from Large*. Since this is not an empirically relevant case we do not pursue it.

[50] It is simple to model such a self-enforcing agreement with trigger strategies that resort only to changes in the non-trade policy. See for example Barret (1994) and Limão (2000).

Given that the trigger strategies during the MTL stage are unchanged, we need only verify if the IC under the different regimes must be modified due to the new welfare function.

Starting with the LSPTA regime, the gains from cooperation expression under regional spillovers, ω^{NC}, must now be augmented:

$$\hat{\omega}^{NC}(\tau^B(\tau^c), e^B(\tau^c), \tau^c) = \omega^{NC}(.) + \gamma$$

There is an extra cost to cooperating if spillovers are global, $\gamma = W^{Le^{S^*}=e^B(\tau^c)} - W^{Le^{S^*}=e^B(\tau^{NL})}$. This corresponds to the foregone public good supply by the small country in the opposite block due to the lower tariff threat that Large* imposes after MTL. The gains from deviation are unchanged. Therefore the most-cooperative tariff under the LSPTA exception is higher when the spillovers are global because large countries now also appropriate the benefits from the LSPTA in the opposite block. When spillovers are regional Large has nothing to gain from an increase in the multilateral tariff of Large*. In contrast, under global spillovers, this increase leads to more cooperation from Small* which also benefits Large.

Under weak commitment the gains from cooperation also reflect an extra cost:

$$\hat{\omega}^{WC}(\tau^B(\tau^{NL}), e^B(\tau^{NL}), \tau^c) = \omega^{WC}(.) - W^{Le^{S^*}=e^B(\tau^{NL})}$$

As we discuss in previous sections, under weak commitment, if cooperation in multilateral tariffs breaks down each large country signs a LSPTA. The gains from the LSPTAs now benefit large countries in both blocks thus raising their payoffs during trade wars. Consequently the gains from multilateral tariff cooperation falls. Because the gains from deviation remain unchanged the most cooperative tariff under weak commitment is higher when the spillovers are global. However, the fall in the gains from cooperation is sharper under weak commitment than under the LSPTA exception. This implies that the building block result from proposition 6 continues to hold and is now more pronounced.

Finally, under strong commitment, it is simple to show that the most cooperative tariff is unchanged since no LSPTAs ever take place. This implies that the stumbling block effect, the difference between the most cooperative tariff under the exception and strong commitment, is stronger when spillovers are global.

The following proposition summarizes the main results when the non-trade externalities have global spillovers.

Proposition 8 *(Generalizations under global spillovers)*

If the public good has global spillovers then:

i. Propositions 3, 4, 6 and 7 still hold.

ii. Both the stumbling and building block effects are more important ($\tau^C = \hat{\tau}^C$, $\tau^{NC} < \hat{\tau}^{NC}$, $\tau^{WC} < \hat{\tau}^{WC}$, $\hat{\tau}^{NC} - \hat{\tau}^C > \tau^{NC} - \tau^C$, $\hat{\tau}^{WC} - \hat{\tau}^{NC} > \tau^{WC} - \tau^{NC}$).

Proof: Follows from propositions 3,4, 6 and 7, the expressions for $\hat{\omega}^{NC}$ *and* $\hat{\omega}^{WC}$ *and the arguments above.*

In sum, allowing the public good to have a global spillover reinforces the results previously derived. The important question now becomes which regime is optimal for the different countries?

5.3 Endogenous choice of MFN rules regime

A government does not typically chose to bind itself by an agreement in order to achieve a particular objective in terms of a policy such as free trade. It only chooses to do so if this maximizes its objective function. As we discuss above, multilateral trading rules have been mainly decided by large countries. Therefore, the main question we answer in this section is the following. If large countries choose the multilateral trading rules to maximize their own objective functions, would they ever choose weak or strong commitment over the LSPTA exception. We also discuss if and when the chosen regime is the one also preferred by small countries.

To answer this we must rank welfare under the different regimes. It is simple to show that no multilateral trade liberalization at all is never better than MTL with a LSPTA exception since, under the exception, large countries can always just choose the discriminatory Nash values which result under no MTL. So, we need only focus on comparing the exception regime with the two commitment alternatives. That is we start from the status quo regime, the LSPTA exception, and ask if a Pareto improvement for large countries is possible by moving to either of the alternative set of rules.

To illustrate the issue, figure 8 depicts Large's welfare function during a cooperation period under the exception, $W^{NC}(\bar{\delta}^S)$, and weak commitment, W^{WC}. For a given MFN tariff Large is always (at least weakly) better off by pursuing a LSPTA since it can always choose not to do so. When $\tau^c = 0$ Large can offer no preferential tariff to Small, so the welfare functions coincide at that point. The reason for the initial increase in welfare at $\tau^c = 0$ is that, in the absence of revenues from Small's exports, a reciprocal increase in τ^c by both large countries has no first order effect on their welfare. Therefore, an increase at that point allows Large to extract tariff revenues from Small. Eventually

this effect is overwhelmed by the distortion imposed by the higher tariffs that large countries set on each other. From proposition 6 we know that the lowest self-enforcing tariff under the exception is lower than under weak commitment Therefore, we have the following proposition:

Proposition 9 *(Welfare under LSPTA vs. weak commitment to MFN)*

The LSPTA exception regime welfare dominates weak commitment to MFN for large countries.

Proof: Follows from propositions 4 and 6.

The proposition is illustrated in figure 8, since the objective function for the exception regime lies everywhere above the one for weak commitment (or at most coincides with it when $\delta^S = 0$) and its IC is less restrictive than under weak commitment Large is weakly better off under the exception. Large is strictly better off if either Large's IC under the LSPTA exception binds at the solution or if $\delta^S > 0$, e.g. when $\delta^S = \bar{\delta}^S$ the solution under the exception is at point NC ($\delta^S = \bar{\delta}^S$) whereas it is at WC under weak commitment (representing the lowest self-enforcing tariff under weak commitment).

Now we ask whether there is any equilibrium situation when welfare under strong commitment exceeds that under a LSPTA exception. Turning again to figure 8, the welfare function is the same under strong or weak commitment. The key difference, as we know from proposition 6, is that the lowest self-enforcing tariff under strong commitment is lower than under the exception regime. To fix ideas suppose that Large is just patient enough so that the cooperative optimum under commitment τ^C is self-enforcing. That is, we define δ^{LC} implicitly as: $\Omega^C(\tau^C) = \frac{\delta^{LC}}{1-\delta^{LC}}\omega^C(\tau^C)$. This means that Large's welfare under commitment is $\bar{W}^C(\delta^{LC}, .)$ defined by point C. If the lowest self-enforcing tariff under the exception is $\tau^{NC}(\delta^{LC}, \bar{\delta}^S)$ then, Large's welfare under the exception, $\bar{W}^{NC}(\delta^{LC}, \bar{\delta}^S)$ is at most the same as under no commitment, $\bar{W}^C(\delta^{LC}, .)$.

One of the important determinants for this comparison is how much Large can extract from the LSPTA with Small. The more impatient Small is the less cooperation it offers in exchange for any given preferential tariff reduction.

Proposition 10 *(Welfare under LSPTA vs. strong commitment to MFN)*

If $\delta^L \leq \delta^{LC}$ and $\delta^S \in [0, \bar{\delta}^S)$ then the strong commitment to MFN regime welfare dominates the LSPTA exception for large countries.

Proof: Please see the appendix.

To understand the intuition for the proposition take the case when Small is extremely impatient ($\delta^S = 0$), then the only self-enforcing policies under a LSPTA are the non-cooperative ones. Therefore, in this extreme case, W^{NC} coincides with W^C as shown in figure 8. If, in addition, Large's multilateral negotiation IC binds at τ^C then the lowest self-enforcing tariff under the exception must be higher than $\tau^C(\delta^{LC})$ (proposition 6). Thus, at this point, we know that Large is strictly better off under commitment as illustrated. The proposition then establishes that this is also true for strictly positive values of δ^S. Figure 8 illustrates a possible critical point $\bar{\delta}^S$ at which the welfare under strong and weak commitment are again equalized.[51]

The basic intuition of the problem that occurs under the exception is the following. After signing a multilateral agreement large countries are tempted to propose a LSPTA using a threat higher than the MFN tariffs. But, knowing this temptation in advance large countries maintain their MFN tariffs relatively higher than under commitment. Now, if the gains from the LSPTA are not sufficiently high, perhaps because Small is impatient, then large countries are better off by committing to strict MFN since it allows them to enforce lower multilateral tariffs.[52]

Before concluding, we discuss the small countries's preferences over different regimes. In particular we want to illustrate two simple points. First, that even though a LSPTA is welfare improving for Small it may prefer a commitment regime. Second, that there are examples where the optimal regime for small and large countries coincide and others when they diverge.

First, if Small is extremely patient then most of the gains from the LSPTA are appropriated by Large leaving Small close to the Nash welfare level (at the threat point τ^{NL}). Therefore, Small prefers either the weak or strong commitment to the exception since both allow it to enjoy the MFN tariff reductions. Since the MFN reductions are higher under strong commitment this regime will dominate the other two for Small.

Second, if Small is extremely impatient and does not value the future then no cooperation is possible through the LSPTA, and Small will face the same MFN tariff as Large*. However, this level of the MFN tariff exceeds that under strong commitment, as we show above, due to the potential for discrimination during trade wars. Therefore, Small also prefers the strong commitment regime in this case. If Small places no weight on the future, the weak commitment and LSPTA exception

[51] We have that $\tau^{NC}(\delta^{LC}, \bar{\delta}^S) < \tau^{NC}(\delta^{LC}, 0)$ if increases in δ^S relax the multilateral tariff IC. As we note in a footnote in page 27 this will depend on the concavity of Ψ. Obviously the result in proposition 10 also holds if $\tau^{NC}(\delta^{LC}, \bar{\delta}^S) > \tau^{NC}(\delta^{LC}, 0)$.

[52] As we note in page 24 the model under which the strong commitment result is derived requires an exogenous constraint so that discriminatory tariffs are not available. If enforcing this constraint is not costly then the welfare comparison we make is valid. But if it is not the cost of such a constraint has to be explicitly included for the welfare comparison to be accurate.

tariffs are identical, thus leaving Small indifferent between the two.

To sum, there are simple examples in which the optimal regimes for Large and Small are identical and others in which they diverge. Both Large and Small are better off under strong commitment when Small is extremely impatient. However, if strong commitment is not a feasible option and Small is extremely patient then there is a divergence between the optimal regime for large countries (LSPTA) and small countries (weak commitment).

6 Conclusion

It has long been recognized that trade is not the only, and often not even the main, motivation for preferential trade agreements.[53] The failure of economists to model these other motives and the effects of such agreements on the multilateral trading system was perhaps due to their implicit nature and the fact that the non-trade commitments often reflected non-economic goals. This is no longer the case. For instance, conditions on non-trade issues were explicit in NAFTA and the Europe Agreements and are also part of the recent US-Jordan FTA. According to the World Bank report on regionalism "[t]he EU has used the Europe Agreements to obtain action on environmental and labor conditions and on intellectual property, and the United States has used NAFTA as a tool for enforcing Mexican labor and environmental standards." (2000, p105). Both the US and the EU's GSP programs lay out specific conditions, related to issues such as labor and environmental standards and the protection of intellectual property, for a country to be eligible for preferential treatment. Therefore, to understand the effects of preferential trade agreements, both in themselves and in relation to the multilateral trading system, we clearly cannot continue to ignore these other aspects of preferential trade agreements.

This paper is a first step in taking these non-trade issues seriously and showing that, even in the absence of significant trade creation or diversion effects, preferential trade agreements can have an important effect on the multilateral trading system. We model the non-trade issue specifically as the provision of a public good, yet this representation is general enough to allow different interpretations. In addition to the interpretations already mentioned in the paper, the public good may also represent transport infrastructure, a regional power grid or other non-private goods, with a cross-border effect, included in agreements alongside trade policy.[54] More importantly, the basic intuition behind our

[53] For example, Schiff and Winters (1997, p.1) cite Kant's 1795 work "Perpetual Peace" (p. 157) as an example of an early discussion of the idea that commercial ties reduce the risk of European wars.

[54] For example the FTA between Chile and Mercosur required Chile to spend $US 100 million on transport infrastructure (Bond 1996). Moreover "[t]he agreements between the EU and the East European and Mediterranean countries

stumbling block result is likely to hold with different representations of the non-trade issue (as long as cooperation in that issue holds some value for the large countries). Lowering MFN tariffs reduces the preferential margins that can be negotiated by any two WTO members. If these preferences have value, for example because they enforce cooperation on some non-trade issue, there is an extra cost to reducing MFN tariffs relative to the case when there is no possibility for a preferential agreement.

How important can this stumbling effect be? This is a difficult question to answer empirically given that we have never observed the counter-factual of strong commitment. However, there is one argument that can be easily dismissed. Skeptics would argue that this effect cannot be very important given the low MFN tariff rates in the US and the EU. This argument is flawed on at least two accounts. First, there are still sensitive sectors, such as agriculture and textiles for example, where the US and the EU's tariffs are high. Moreover, these are some of the sectors in which developing countries export to the EU and US and therefore precisely the sectors that our model predicts are relevant to consider. That is, by reducing its MFN tariff on computer chips from 100 to zero, the EU loses no bargaining power over Latin American countries exporting bananas, it is protection on bananas that is relevant.[55]

The second flaw in the argument above is that large tariff reductions have often been offset by increases in non-tariff measures with the result that *effective* protection is not as low as indicated by the tariff level. A clear example of this is the increase in the use of anti-dumping and associated countervailing duties in the US.[56] Clearly our model would have to be modified to deal with non-tariff barriers, which become the relevant threat point when MFN tariffs are low. However, it is likely that the basic intuition of the result would again hold if these non-trade barriers became the subject of negotiation in the WTO. In that case, the US opposition to discuss proposals for stricter anti-dumping rules in the 1999 Seattle ministerial meeting of the WTO supports the stumbling block prediction.

Even if we accept that the stumbling effect is important one could still argue that it is irrelevant if there is no way to enforce a strong commitment to MFN. When governments have access to discriminatory tariffs we model simple trigger strategies that support weak commitment but not

also include numerous initiatives for joint cross-border projects, covering transport networks, energy, environment, and other infrastructure projects." World Bank (2000, p.22). Modelling investment in public goods that do not depreciate fully every period would clearly require a change in our model and most importantly on the repeated game.

[55] The EU's GSP program provides for reductions of up to 35% of its MFN rates on industrial *and* agricultural goods. UNCTAD (1998, p.6).

[56] Moreover there is always the risk that those low tariffs return to higher levels. As Perroni and Whalley (1994) argue, an important motivation for small countries to pursue preferential agreements with larger ones in the recent years has precisely been to ensure against the possibility of a trade war and gain a more secure access to the large country's market.

strong commitment to MFN. However, it is simple to model and implement similar strategies that support strong commitment. Suppose we model the trade war to last a fixed number of periods or to occur only on a set number of goods when no LSPTA is signed during that period. Then threatening to increase the length of time or the number of goods used for the punishment during a trade war could dissuade a large country from signing a LSPTA. Alternatively, if there is a third large country, C, it can act as an enforcer by punishing countries A or B if either signs a LSPTA during a trade war with each other.[57]

If the stumbling effect is important and there exist instruments to enforce strong commitment to MFN, then why is it not the current regime? One possibility is that the enforcement constraints do not bind. Another possibility is that large countries gain sufficiently from the LSPTA to offset the gains provided by the lower tariffs under commitment. However, it is important to note that this does not imply that the exception regime is also the preferred one by the rest of the world. First, in the context of the model, although LSPTAs leave small countries better off for given MFN tariffs we provided examples when Small prefers either of the commitment regimes to the LSPTA. Second, suppose we introduce additional small countries, similar to the ones modelled except that they have nothing to offer to the large countries through a LSPTA. These additional countries would prefer the strong commitment regime since it entails lower MFN tariffs. The key point is that the possibility of LSPTAs can have a negative welfare effect on non-members through higher MFN tariffs even in the absence of trade creation or diversion effects.

We conclude with a suggestion for future work that addresses when it may be optimal to pursue linkages regionally rather than multilaterally. When linkages take place multilaterally and in the context of the WTO, the threat used to enforce cooperation in non-trade issues is the non-cooperative level of the MFN tariff.[58] Given that this constitutes a bigger threat than the cooperative level of the MFN tariff, we may ask why large countries have only recently pursued multilateral linkages more vigorously. The level of the tariffs achieved when linkages occur multilaterally must be extended to all members because of MFN. This suggests that an important reason why multilateral linkages are only now being more vigorously pursued is that LSPTAs extract more cooperation when the cooperative value of MFN tariff is close to its non-cooperative level, that is when large countries cannot sustain much multilateral liberalization. Under those circumstances the use of a stick, i.e. the threat of the non-cooperative MFN tariff in the WTO, is not as effective as the use of a carrot, in the form of lower than MFN tariffs channeled through LSPTAs. So, if, as the data indicate, there is a process by which

[57] Third party enforcement is, according to Maggi (1999), an important mechanism of cooperation in the GATT.
[58] Limão (2000).

large countries are gradually able to sustain lower cooperative MFN tariffs, they eventually find it optimal to switch from regional to multilateral linkage. This is not only an interesting theoretical extension but, more importantly, a testable hypothesis of the timing of the shift from regional to multilateral linkage of any given non-trade issue.

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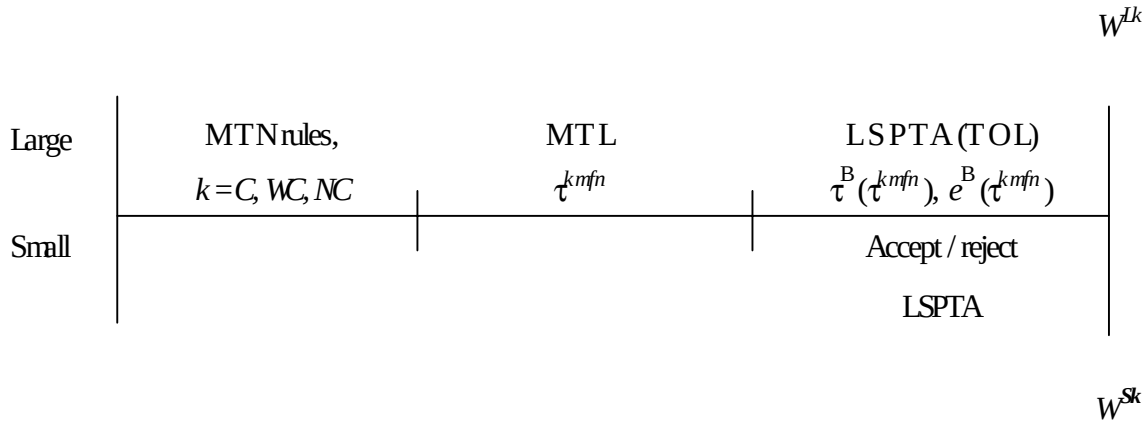
Figure 1

Timing of governments' actions in each period of the repeated game

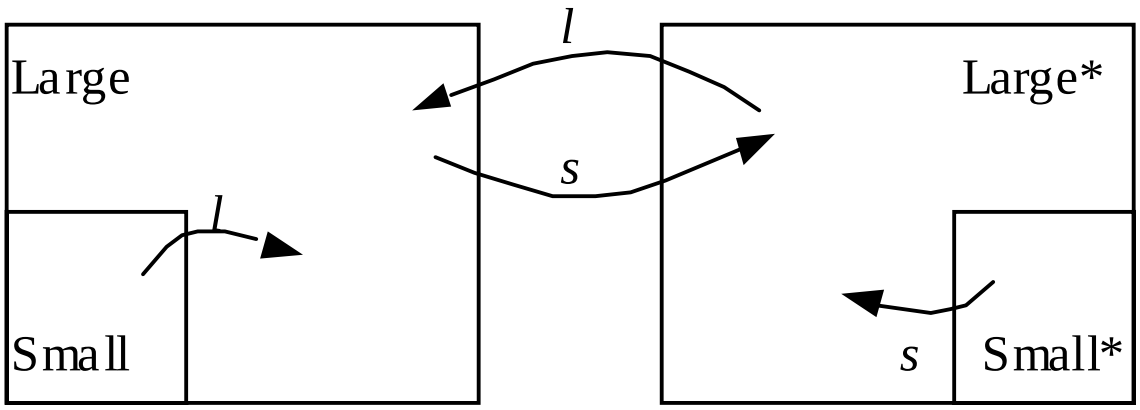


Notes:

Large countries first choose the multilateral trading negotiation rules (MTN) by adopting one of three alternative regimes (k). The options considered are a strong commitment to MFN (C), a weak commitment to MFN (WC) or a LSPTA exception (NC). Given the regime large countries then choose a level for the tariff vis-à-vis each other ($\tau^{k\ mfn}$). This is also the maximum credible threat that can be subsequently used to make a take-it-or-leave-it offer (TOL) for a LSPTA, during periods of mulilateral cooperation, which Small can accept or reject. This offer occurs in the final phase of each period and is simply the vector (τ^{B}, e^{B}), the value for Large's tariff on the imports from Small and a tax level for Small's provision of the public good.

Figure 2

Pattern of Trade



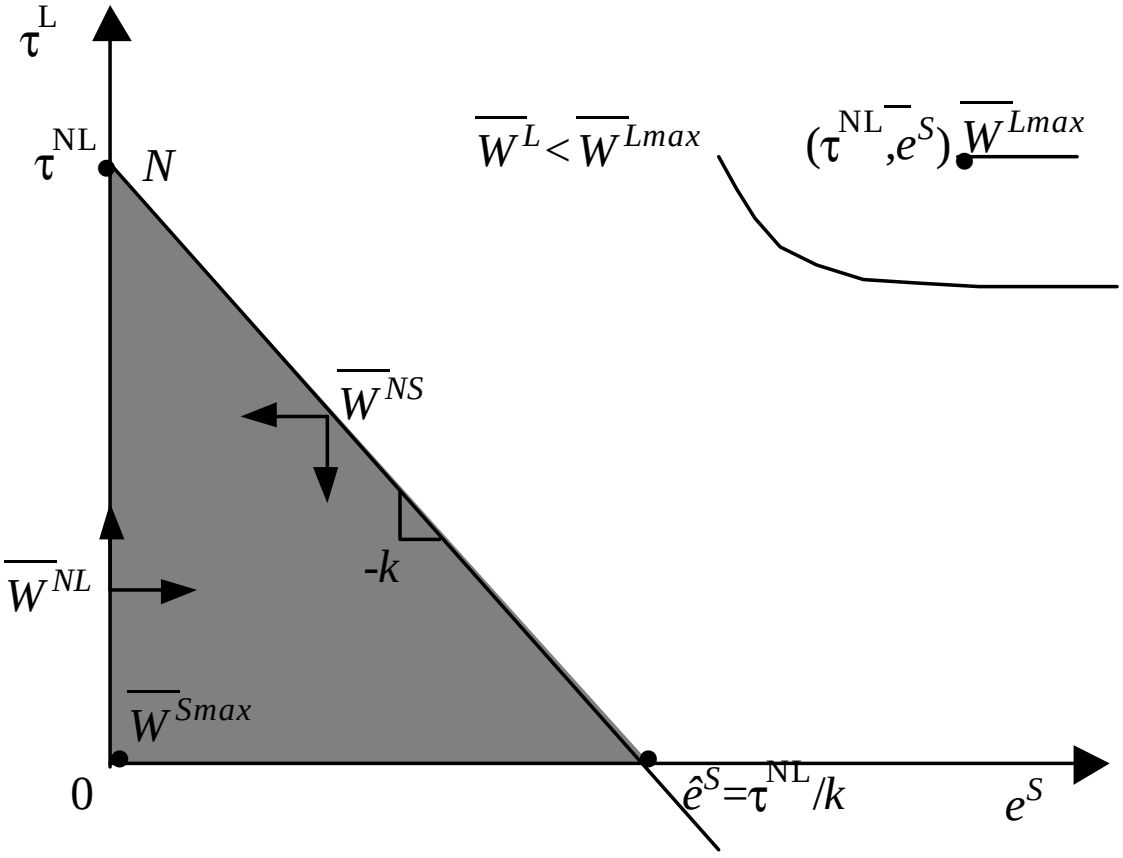
Notes:

Each of the symmetric regional blocks is composed of a large and small country. The arrows denote the direction of exports. We assume that trading costs (due to transport or information for example) are prohibitively high between small and large countries in opposite blocks. The balance of payments condition is satisfied via the numeraire good.

Figure 3

Non-cooperative regional outcome (*N*) and feasible Pareto improvements from a LSPTA

(no enforcement constraints)



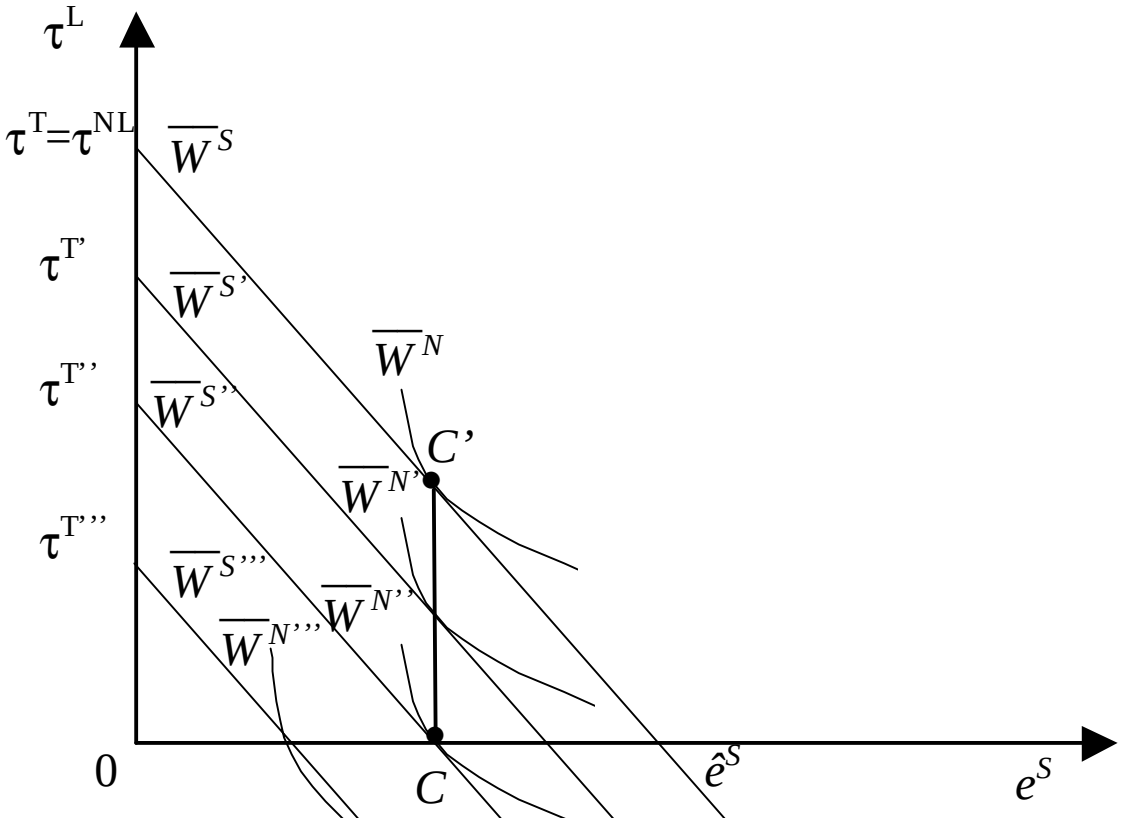
Notes:

Point *N* denotes the non-cooperative solution to Large's tariff on Small and the latter's e-tax, (τ^L=0, e^S=0). The slope of Small's iso-welfare line is -*k*<-1, the ratio of Large to Small's endowments. The optimum solution for Large is at (τ^{NL}, $\bar{e}$) and for Small it is (τ^L=0, e^S=0).

Figure 4

Pareto efficient LSPTAs (0*CC'*) given different tariff threats (τ^T)

(no enforcement constraints)

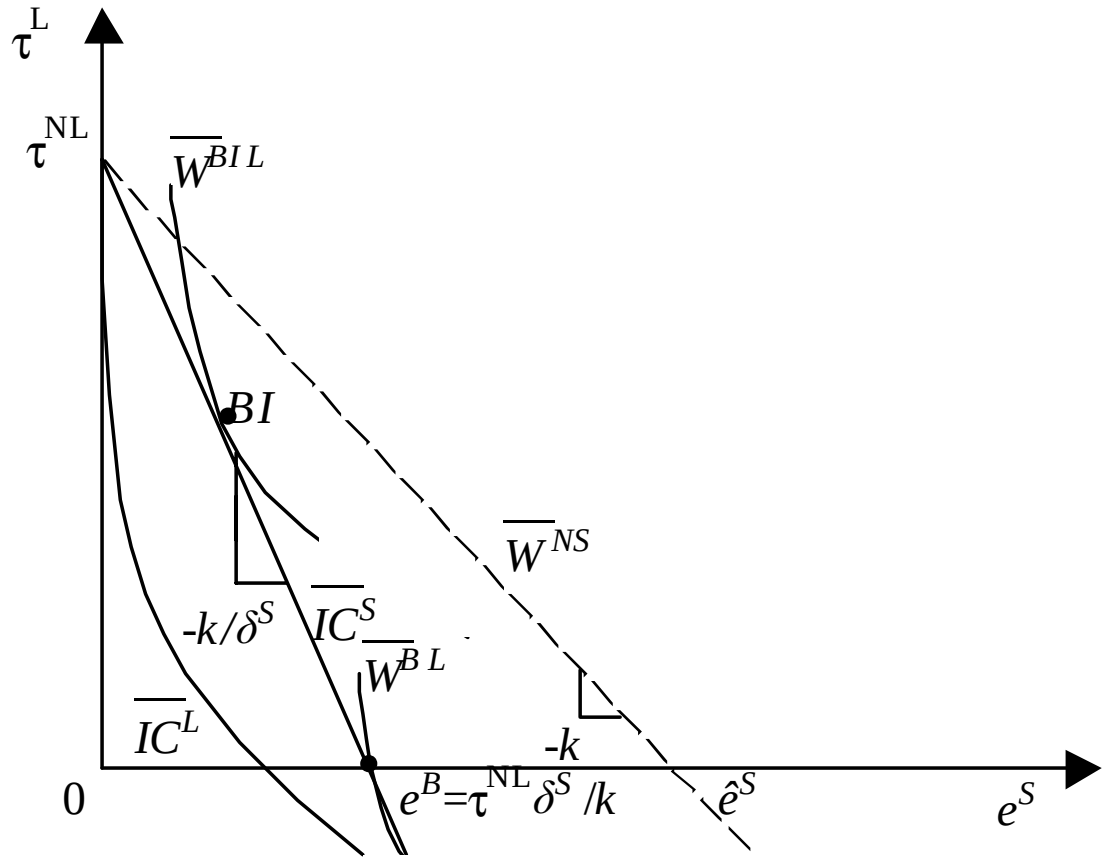


Notes:

In the case depicted the MRS of the policies in welfare for Large is lower than that for Small at $\tau^L=0$, $e^S=\hat{e}^S$. Therefore, the Pareto efficient solution is an interior one. The solution is at *C'* when Large's tariff threat is the Nash value but for a sufficiently low tariff threat ($\leq\tau^{T''}$) the efficient solution requires a duty free LSPTA along 0*C*. The segment *CC'* of the contract curve is vertical because changes in Large's tariff on Small have only tariff revenue effects. Moreover these effects are constant at different levels of the tariff and therefore have no impact on the slope of the iso-welfare curves.

Figure 5 LSPTA self-enforcing solutions

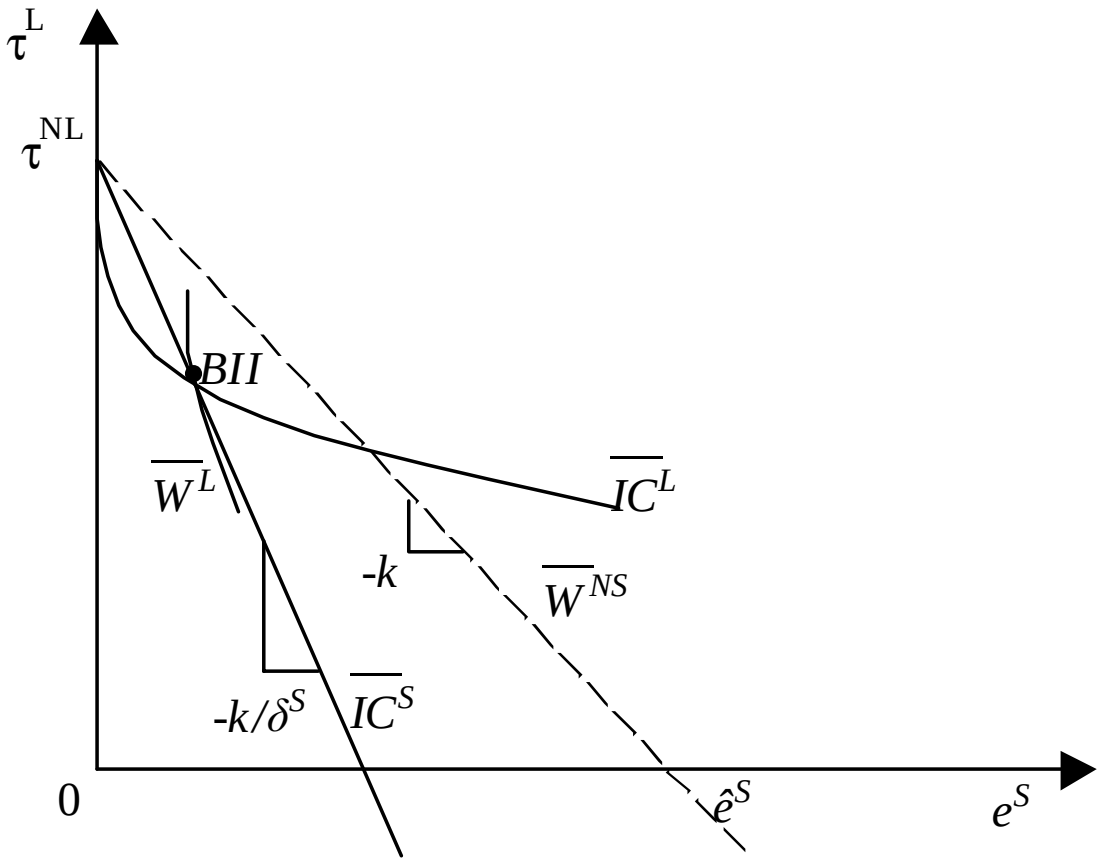
5a. LSPTA self-enforcing solutions: Large sufficiently patient



Notes:

The slope of Small's iso-incentive constraint is $-k/\delta^S<-1$, where k is the ratio of Large to Small's endowments and $\delta^S<1$ is Small's discount factor. Large's iso-incentive constraint also intersects the vertical axis at τ^{NL} and when Large is sufficiently patient it does not intersect Small's iso-IC at a positive τ^L. If Large places sufficient weight on the public good provision the solution is at the corner e^B. Otherwise it is at *BI*.

5b. LSPTA self-enforcing solution: Large insufficiently patient patient (binding IC^L)

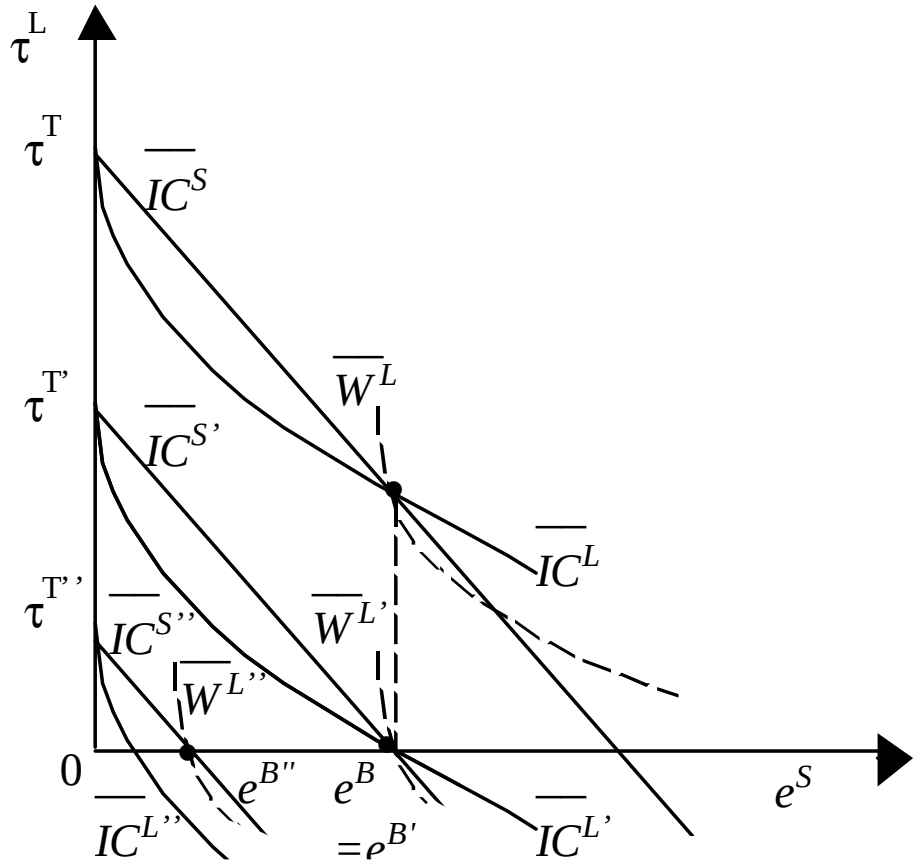


Notes:

In the case depicted Large is not sufficiently patient at the Nash threat tariff τ^{NL} and therefore the LSPTA solution is found at *BII*, the intersection of Large and Small's iso-IC.

Figure 6

Pareto efficient self-enforcing LSPTAs given different tariff threats (τ^T)

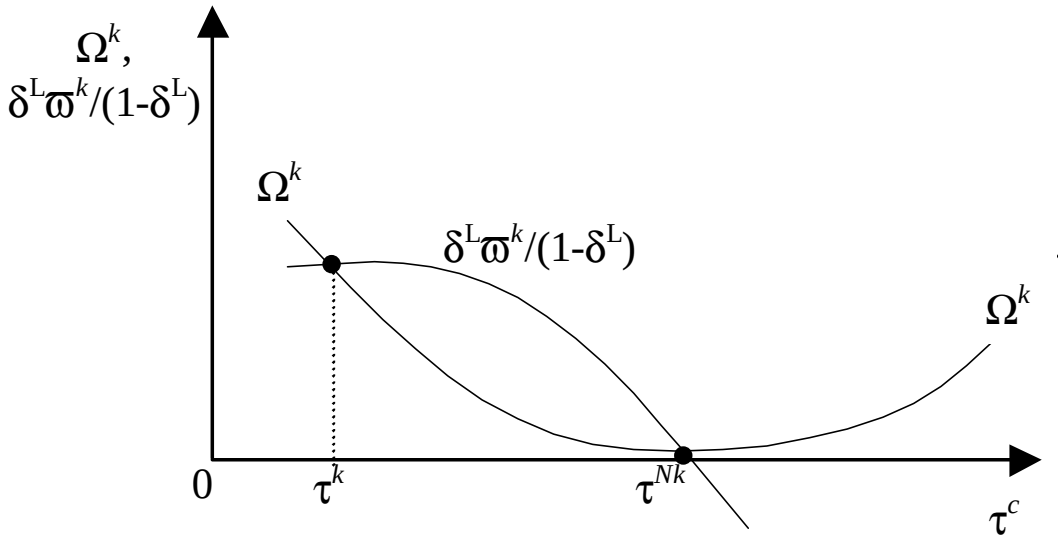


Notes:

In the case depicted Large is not sufficiently patient at the initial threat tariff, τ^T, therefore its IC binds. Reductions in Large's tariff threat do not affect the MRS of the policies in enforcement (the slopes of the iso-IC) but shift both Large and Small's iso-IC down by the same amount. For sufficiently low tariff threat a duty-free LSPTA becomes self-enforcing.

Figure 7

Most-cooperative MFN tariff for a given rules regime, τ^k

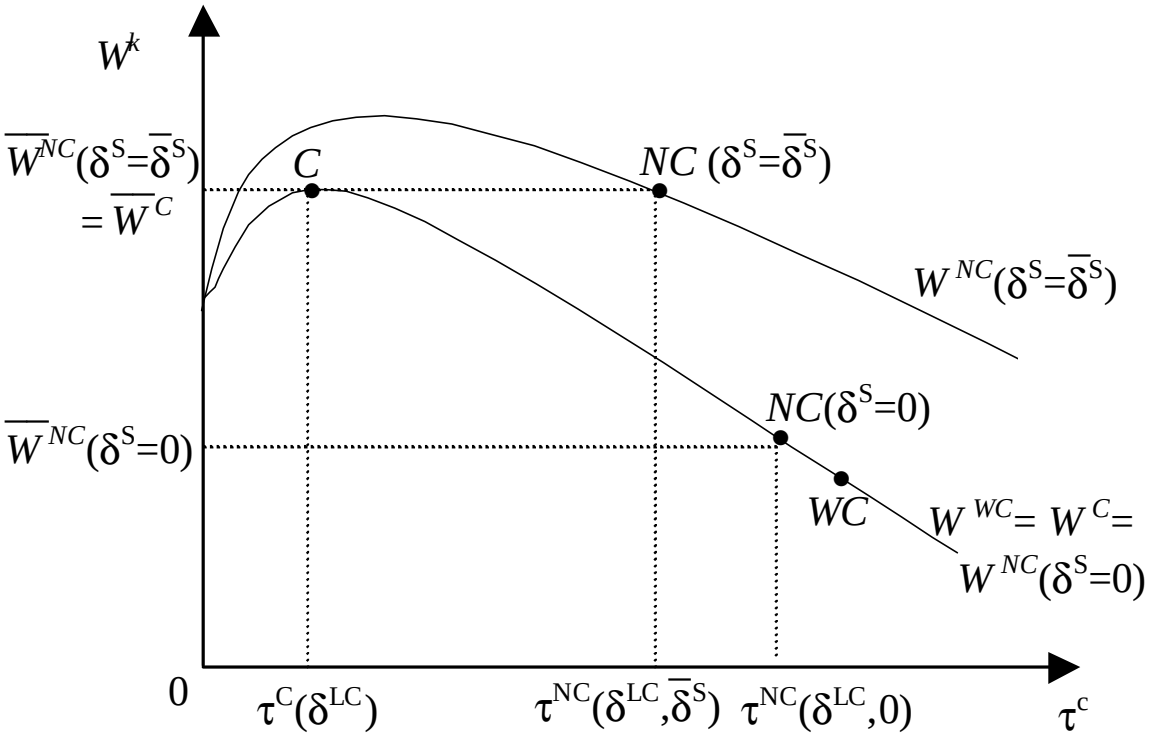


Notes:

The period gain of deviating from cooperation, Ω^k, and the gains from cooperating, $\delta^L\omega^k/(1-\delta^L)$, differ across each of the alternative regimes, *k*, considered (strong commitment to MFN, weak commitment to MFN and LSPTA exception). The non-cooperative value of the MFN tariff under regime *k* is τ^{Nk}. The convexity of Ω^k and concavity of ω^k are sufficient to ensure that there exist at most two levels of the MFN tariffs that satisfy the IC present in the multilateral trade liberalization process.

Figure 8

Optimal MFN rule regime for large countries



Notes:

When Large's discount factor is δ^{LC} the incentive constraint under strong commitment to MFN binds at the cooperative solution under that regime, at *C*. When Small does not discount the future ($\delta^S=0$) the welfare functions under commitment are identical to the LSPTA exception for any given value of τ^c. In this case the exception solution is at *NC* ($\delta^S=0$). The welfare function under the exception is also illustrated for the critical value of δ^S at which the maximized value under strong commitment and the exception are equalized.

A Appendix

A.1 FOC for Nash policies in Large

The level of the e-tax in Large is implicitly defined by:

$$W_{e^L}^{Le^L} = 0 : b^L H^L \bar{\Psi}'(b^L H^L e^{NL}) - 1 = 0$$

Discriminatory Nash tariffs (τ^{NL}, τ^{Nmfn}):

Assume first that Small's excess demand is a step function: $[0, H^S/k]$ for $p^S = p^{S\max}$, H^S/k for $p^S > p^{S\max}$. In this case:

$$\tau^{NL} = p^L - p^{S\max}$$

Since a $\tau^{NL} > p^L - p^{S\max}$ is prohibitive and at $\tau^{NL} < p^L - p^{S\max}$ Large can increase τ^{NL} and collect the extra revenue at no cost. Because Small has no demand for good l we have that $p^{S\max} = 0$. Replacing the expression above for τ^L into eq.(5) and obtain the FOC for τ^{Nmfn}:

$$-p_\tau M^L - \{p_\tau M^S + M^{L^*} + (p_\tau - 1) M_p^{L^*} \tau^{mfn}\} = 0$$

Where $p_\tau \equiv \frac{\partial p_l^L}{\partial \tau}$ and $M_p^J \equiv \frac{\partial M_l^{LJ}}{\partial p_l^J}$. Simplifying and using the market clearing condition yields eq.(6)

Non-discriminatory Nash tariff (τ^N):

Substituting $\tau^L = \tau^{mfn} = \tau$ and differentiating eq.(5) we obtain the FOC for τ^N. Assume that τ^N entails $p^S \geq 0$ such that $M^S = -H^S/k$ (we will verify this is the case below), then we have $W_\tau^{L\tau^{mfn}=\tau^L=\tau} = 0$:

$$-p_\tau M^L - \{M^S + M^{L^*} + (p_\tau - 1) M_p^{L^*} \tau^N\} = 0$$

Comparing this expression with $W_{\tau^{mfn}}^{L\tau^{mfn}\tau^L=\tau^{NL}} = 0$ it is clear that, at $\tau = \tau^{Nmfn}$, $W_\tau^{L\tau^{mfn}=\tau^L=\tau} > 0$. Therefore $\tau^N > \tau^{Nmfn}$. This in turn implies that, at the optimum value, τ^N, we have $W_{\tau^{mfn}}^{L\tau^{mfn}\tau^L=\tau^{NL}} < 0$. This implies that, at τ^N, a reduction in the non-discriminatory tariff cannot improve Large's welfare derived from its imports from Small. For, if it did, then Large would be better off on the two "margins" (the two sources of imports) and satisfy the equality constraint ($\tau^{mfn} = \tau^L$). So we must have that, at τ^N, $p^S \geq 0$. Simplifying and using the market clearing condition yields eq(8).

A.2 Proofs

Proposition 1:

First $\tau^{NL} > \tau^{Nmfn}$. A value of τ^{Nmfn} leading to no trade with Large* is not a Nash equilibrium, therefore $p^{L*} > 0$. Now $p^{L*} = p^L - \tau^{Nmfn} = \tau^{NL} - \tau^{Nmfn}$, thus $\tau^{NL} - \tau^{Nmfn} > 0$. In the Nash FOC above we explain why, at τ^{NL} and τ^N, $p^S \geq 0$ and also why $\tau^N > \tau^{Nmfn}$. □

Proposition 2:

Any efficient bargaining process with no bargaining costs must take place along the efficiency locus. The highest credible threat that Large can use under discriminatory tariffs is $\tau^L = \tau^{NL}$. The definitions for sufficiently high λ^L or α^L are sufficient to determine that $\{\frac{W^L_{e^S}(\bar{g})}{W^L_{\tau^L}} > \frac{W^S_{e^S}}{W^S_{\tau^L}}\}|_{\tau^L=0, e^S=\hat{e}}$. The slope of Small's iso-welfare curves do not change at lower levels of e^S for a given τ^L and the MRS for Large increases as we move towards $e^S = 0$ therefore $\{\frac{W^L_{e^S}(\bar{g})}{W^L_{\tau^L}} > \frac{W^S_{e^S}}{W^S_{\tau^L}}\}|_{\tau^L=0, e^S<\hat{e}}$.□

Proposition 3:

The FOC to Φ^{LSPTA} require:

$W^L_k - \Sigma_J \mu^J(\Omega^J_k - \frac{\delta^J}{1-\delta^J}\omega^J_k) + \phi^k = 0$

$\mu^J(\Omega^J - \frac{\delta^J}{1-\delta^J}\omega^J) = 0$

$\phi^k k = 0$

$\mu^J,\ \phi^k \geq 0$

$J = L,\ S$ and $k = \tau^L,\ e^S$

First it is obvious that if $\Omega^S < \frac{\delta^S}{1-\delta^S}\omega^S$ at the solution then an increase in e^S is feasible and optimal which implies that $\Omega^S = \frac{\delta^S}{1-\delta^S}\omega^S$. From this we have that $e^B = \frac{\delta^S}{k}(\tau^{NL} - \tau^B)$, where we use the definitions in eqs.(4, 9, 11).

By definition, if $\delta^L \geq \bar{\delta}^L$ then $\Omega^L \leq \frac{\delta^L}{1-\delta^L}\omega^L$ at $\tau^B = 0$, $e^B = \frac{\delta^S}{k}\tau^{NL}$. The FOC then yield $\frac{W^L_{e^S}}{W^L_{\tau^L}} \geq \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$. This inequality is true by definition iff Large's weight on the public good consumption, λ^L, or the degree of the cross-border effect, α^L, are sufficiently high. When $\delta^L < \bar{\delta}^L$ then, by definition, $\overline{IC}^L$ and $\overline{IC}^S$ intersect at $\tau^L > 0$. Therefore, when $\delta^L < \bar{\delta}^L$, there are two cases. First, if $\Omega^L < \frac{\delta^L}{1-\delta^L}\omega^L$ then the FOC require $\frac{W^L_{e^S}}{W^L_{\tau^L}} = \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$, this condition, jointly with $e^B = \frac{\delta^S}{k}(\tau^{NL} - \tau^B)$, determines τ^B. Second, if $\Omega^L = \frac{\delta^L}{1-\delta^L}\omega^L$ then $\tau^{NL} - \tau^B = \frac{\delta^L k}{H^S}H^L\alpha^L\bar{\Psi}(b^S H^S e^B)$ by using eqs.(5, 9, 11). In the second case the FOC require $\frac{W^L_{e^S}}{W^L_{\tau^L}} \geq \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$.□

Proposition 4:

If δ^S or $\delta^L = 0$ the only self-enforcing solution is the Nash point. If $\delta^S = 1$ then Small's iso-IC

coincides with its iso-welfare curve through $\hat{e}$ in figure 5 and therefore the self-enforcing solution maintains Small at the Nash welfare level. If $\delta^S \in (0,1)$ then the self-enforcing solution requires $\omega^S > 0$. If $\omega^S = 0$ then Small's IC can only be satisfied if it sets $e^{cS} = 0$ because otherwise $\Omega^S = H^S e^{cS} > \omega^S \delta^S/(1-\delta^S) = 0$. A similar argument holds for Large.□

Proposition 5:

First we show that if initially $\tau^B = 0$ then the preferential tariff after the MFN reduction, $\tau^{B'}$, is also zero. From proposition 3, $\tau^B = 0$ if, at $e^B = \tau^T \delta^S/k$, $\overline{IC}^L$ intersects $\overline{IC}^S$ at $\tau^L \leq 0$ and $\frac{W^L_{e^S}}{W^L_{\tau^L}} \geq \frac{W^S_{e^S}}{W^S_{\tau^L}} \frac{1}{\delta^S}$ as at point $e^{B'}$ in figure 6 when $\tau^{T'}$ is the threat. From the definitions of IC^L and IC^S a reduction in τ^T shifts $\overline{IC}^L$ and $\overline{IC}^S$ down by the same amount which is equal to the change in the threat as illustrated in figure 6. Therefore at $\tau^{T''} < \tau^{T'}$ the iso-IC intersect at $\tau^L < 0$. At $\tau^{B''} = 0$, $e^{B''} = \tau^{T''} \delta^S/k < e^{B'}$ we have $\frac{W^L_{e^S}}{W^L_{\tau^L}} > \frac{W^S_{e^S}}{W^S_{\tau^L}} \frac{1}{\delta^S}$ given $\Psi'' < 0$. A sufficiently low yet positive tariff threat, $\tau^{T'}$, which induces a duty-free tariff exists when $\delta^S > 0$ because when Large's iso-IC intersects Small's at $e^S \to 0$, $\tau^L \to \tau^T$ $\lim_{e^S \to 0} \delta^L \frac{W^L_{e^S}}{W^L_{\tau^L}} > \frac{W^S_{e^S}}{W^S_{\tau^L}} \frac{1}{\delta^S}$ so the second intersection is at $e^S > 0$, $\tau^L < \tau^T$. If $\tau^T \to 0$ then a $\tau^{T'} > 0$ exists.

Large's total change in welfare from a reciprocal MFN tariff reduction without a MFN exception is

$$dW^L = -(W^L_{\tau^{mfn}} + W^L_{\tau^{mfn^*}} + W^L_{\tau^L}) d\tau^{mfn}$$

since $\tau^L = \tau^{mfn}$. With a LSPTA exception the threat point is $\tau^T = \tau^{mfn}$ and therefore $\tau^B = \tau^B(\tau^T = \tau^{mfn})$ and $e^B = e^B(\tau^T = \tau^{mfn})$. Therefore

$$dW^{LLSPTA} = -(W^L_{\tau^{mfn}} + W^L_{\tau^{mfn^*}} + W^L_{\tau^L} \frac{\partial \tau^B}{\partial \tau^T} + W^L_{e^S} \frac{\partial e^B}{\partial \tau^T}) d\tau^{mfn}$$

Large's extra welfare gain from the reduction of MFN tariffs without the LSPTA exception is:

$$\begin{aligned} dW^L - dW^{LLSPTA} &= -(W^L_{\tau^{mfn}} + W^L_{\tau^{mfn^*}} + W^L_{\tau^L}) d\tau^{mfn} \\ &\quad + (W^L_{\tau^{mfn}} + W^L_{\tau^{mfn^*}} + W^L_{\tau^L} \frac{\partial \tau^B}{\partial \tau^T} + W^L_{e^S} \frac{\partial e^B}{\partial \tau^T}) d\tau^{mfn} \\ &= -W^L_{\tau^L} d\tau^{mfn} + (W^L_{\tau^L} \frac{\partial \tau^B}{\partial \tau^T} + W^L_{e^S} \frac{\partial e^B}{\partial \tau^T}) d\tau^{mfn} \\ &= ((\frac{\partial \tau^B}{\partial \tau^T} - 1) W^L_{\tau^L} + W^L_{e^S} \frac{\partial e^B}{\partial \tau^T}) d\tau^{mfn} \end{aligned}$$

If at the initial LSPTA $\tau^B = 0$ then at the final LSPTA $\tau^B = 0$, as we show above, so $\frac{\partial \tau^B}{\partial \tau^T} = 0$,

$\frac{\partial e^B}{\partial \tau^T} = \frac{\delta^S}{k}$.Therefore

$$dW^L - dW^{LLSPTA} = (-W^L_{\tau^L} + W^L_{e^S}\frac{\delta^S}{k})d\tau^{mfn} > 0$$

because $\frac{W^L_{e^S}}{W^L_{\tau^L}} > \frac{k}{\delta^S}$ is the FOC for the duty-free LSPTA when $\delta^L \geq \bar{\delta}^L$.

If, after the MFN reduction, $\tau^B > 0$ then, as we show above, at the initial LSPTA $\tau^B > 0$ therefore we are either at τ^{BI} or τ^{BII}. At either of these $\frac{\partial \tau^B}{\partial \tau^T} = 1$, $\frac{\partial e^B}{\partial \tau^T} = 0$ (from using the IFT on the solutions in proposition 3) and therefore $dW^{LLSPTA} - dW^L = 0$.

However, even when at the initial LSPTA $\tau^B > 0$, there exists a final MFN tariff which is sufficiently low to induce a duty-free LSPTA, as we show above. Then $dW^{LLSPTA} - dW^L = (-W^L_{\tau^L} + W^L_{e^S}\frac{\delta^S}{k})\Delta\tau^{mfn} > 0$ where $\Delta\tau^{mfn}$ is the difference between the critical τ^T at which $\tau^B = 0$ and the final MFN tariff.□

Proposition 6:

LSPTA as a building block ($\tau^{NC} < \tau^{WC}$)

By definition at τ^{NC}, $\Omega^{NC}(\tau^{NC}) = \frac{\delta^L}{1-\delta^L}\omega^{NC}(\tau^{NC})$ now, $\tau^{NC} < \tau^{WC}$ if at τ^{NC} we have $\Omega^{WC}(\tau^{NC}) > \frac{\delta^L}{1-\delta^L}\omega^{WC}(\tau^{NC})$. For this it is sufficient that

$$\begin{aligned} \Omega^{WC}(\tau^{NC}) &> \Omega^{NC}(\tau^{NC}) \\ \omega^{WC}(\tau^{NC}) &< \omega^{NC}(\tau^{NC}) \end{aligned}$$

since these jointly imply that:

$$\frac{\delta^L}{1-\delta^L}\omega^{WC}(\tau^{NC}) < \frac{\delta^L}{1-\delta^L}\omega^{NC}(\tau^{NC}) = \Omega^{NC}(\tau^{NC}) < \Omega^{WC}(\tau^{NC})$$

Starting with the gains from deviation:

$$\begin{aligned} \Omega^{WC}(\tau^{NC}) - \Omega^{NC}(\tau^{NC}) &= W^{L\tau^L=\tau^B(\tau^c),\tau^{mfn}=\tau^c} - W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c} + W^{Le^S=e^B(\tau^c)} \\ &= (\tau^B(\tau^c) - \tau^c)H^S/k + W^{Le^S=e^B(\tau^c)} \\ &> (\tau^B(\tau^c) - \tau^c)H^S/k + \delta^L W^{Le^S=e^B(\tau^c)} \\ &\geq 0 \end{aligned}$$

The first equality results from applying the definitions of Ω and simplifying, the second uses the definition of $W^{L\tau^L,\tau^{mfn}}$. The inequality in the third line assumes $\delta^L < 1$ and uses the fact that W^{Le^S}

is positive if $e^B(\tau^c) > 0$. The last inequality simply states that Large's IC which must be satisfied by any self-enforcing LSPTA which has τ^c as the threat point.

Similarly, we can show that $\omega^{WC}(\tau^{NC}) < \omega^{NC}(\tau^{NC})$ since $\omega^{WC}(\tau^{NC}) - \omega^{NC}(\tau^{NC}) = -(\Omega^{WC}(\tau^{NC}) - \Omega^{NC}(\tau^{NC}))$.

LSPTA as a stumbling block ($\tau^{NC} > \tau^C$):

Following the proof above we show that:

$$\begin{aligned} \Omega^C(\tau^{NC}) &< \Omega^{NC}(\tau^{NC}) \\ \omega^C(\tau^{NC}) &> \omega^{NC}(\tau^{NC}) \end{aligned}$$

Starting with the relative gains from cooperation:

$$\omega^C(\tau^{NC}) - \omega^{NC}(\tau^{NC}) = A + B + C + D > 0$$

$$\begin{aligned} A &= W^{L\tau^L=\tau^c,\tau^{mfn}=\tau^c} - W^{L\tau^L=\tau^B(\tau^c),\tau^{mfn}=\tau^c} \\ B &= W^{L\tau^{mfn^*}=\tau^{Nmfn}} - W^{L\tau^{mfn^*}=\tau^N} \\ C &= W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} - W^{L\tau^L=\tau^N,\tau^{mfn}=\tau^N} \\ D &= W^{Le^S=e^B(\tau^{NL})} - W^{Le^S=e^B(\tau^c)} \end{aligned}$$

We must consider two possible cases for the preferential tariff.

Case I. The LSPTA is either not duty-free, $\tau^B(\tau^c) > 0$, or is "just" duty-free, $\tau^B(\tau^c) = 0 \wedge \tau^B(\tau^{c+}) > 0$, during periods of multilateral cooperation, $\tau^{mfn} = \tau^c$.

Lemma 1: Under case I, $A + C \geq 0, B > 0$ and $D = 0$.

Proof:

Under case I $e^B(\tau^c) = e^B(\tau^{NL})$ and therefore $D = 0$. The equality $e^B(\tau^c) = e^B(\tau^{NL})$ follows directly if we note that: i) $\tau^{NL} > \tau^{Nmfn} > \tau^c$ (from proposition 1 and our assumption that large countries are sufficiently patient so that MTL results in lower tariffs which imply) and ii) under either τ^{BI} or τ^{BII} moving from threat point τ^{NL} to τ^c lowers τ^B from $\tau^B(\tau^{NL})$ to $\tau^B(\tau^c)$ but not e^B (proposition 3).

To prove $A + C \geq 0$ we expand A using the definition of $W^{L\tau^L,\tau^{mfn}}$ and proposition 3 and define a

new term, C'.

$$\begin{aligned} A &= (\tau^c - \tau^B(\tau^c))H^S/k \\ &= e^B(\tau^c)H^S/\delta^S \end{aligned}$$

$$\begin{aligned} C' &\equiv W^{L\tau^L=\tau^B(\tau^{NL}),\tau^{mfn}=\tau^{Nmfn}} - W^{L\tau^L=\tau^{NL},\tau^{mfn}=\tau^{Nmfn}} \\ &= -(\tau^{NL} - \tau^B(\tau^{NL}))H^S/k \\ &= -e^B(\tau^{NL})H^S/\delta^S \end{aligned}$$

Now, $A+C \geq 0$ because $A+C'=0$ (since $e^B(\tau^c) = e^B(\tau^{NL})$) and $C-C' = W^{L\tau^L=\tau^{NL},\tau^{mfn}=\tau^{Nmfn}} - W^{L\tau^L=\tau^N,\tau^{mfn}=\tau^N} \geq 0$ (since τ^{NL}, τ^{Nmfn} are the maximizers for $W^{L\tau^L,\tau^{mfn}}$ whereas τ^N is the constrained maximizer for $W^{L\tau^L,\tau^{mfn}}$, if the constraint, $\tau^L = \tau^{mfn}$, binds the inequality is strict).
$B > 0$ since $\tau^N > \tau^{Nmfn}$(proposition 1) and therefore Large's export price is lower when Large* set τ^N instead of τ^{Nmfn}. Moreover, W^L is independent of τ^{L^*} directly (τ^{L^*} does not affect the prices in Large* when all endowments are being exported from Small* to Large*).
Case II. The LSPTA is duty-free, $\tau^B(\tau^c) = 0 \wedge \tau^B(\tau^{c+}) = 0$, during periods of multilateral cooperation, $\tau^{mfn} = \tau^c$.
Lemma 2: Under case II, $A + C' + D > 0$ and $B > 0$.
Proof:
From proposition 5 we have that if $\tau^{NL} > \tau^c$ and the LSPTA is duty-free then $e^B(\tau^{NL}) > e^B(\tau^c)$. Using the definitions above we rewrite $A + C' > -D$ as:

$$\begin{aligned} \{e^B(\tau^c) - e^B(\tau^{NL})\}H^S/\delta^S &> -(W^{Le^S=e^B(\tau^{NL})} - W^{Le^S=e^B(\tau^c)}) \\ H^S/\delta^S &< \frac{W^{Le^S=e^B(\tau^{NL})} - W^{Le^S=e^B(\tau^c)}}{e^B(\tau^{NL}) - e^B(\tau^c)} \end{aligned}$$

Now, due to the strict concavity of Ψ and therefore of W^{Le^S}, $\frac{W^{Le^S=e^B(\tau^{NL})} - W^{Le^S=e^B(\tau^c)}}{e^B(\tau^{NL}) - e^B(\tau^c)} > W_{e^S}^{Le^S=e^B(\tau^{NL})} \geq H^S/\delta^S$. Where the last inequality is true in any self-enforcing LSPTA when the threat point is τ^{NL} since the FOC for it require that the slope of Large's iso-welfare at the solution be at least as steep as that of Small's iso-IC ($\frac{W^L_{e^S}}{W^L_{\tau^L}} \geq \frac{W^S_{e^S}}{W^S_{\tau^L}}\frac{1}{\delta^S}$ <=> $W_{e^S}^{Le^S} \geq H^S/\delta^S$). Here, since the LSPTA is duty-free, $W_{e^S}^{Le^S} > H^S/\delta^S$.
$B > 0$ as under case I.

Similarly, we can show that $\Omega^C(\tau^{NC}) < \Omega^{NC}(\tau^{NC})$ since $\Omega^C(\tau^{NC}) - \Omega^{NC}(\tau^{NC}) = -(\omega^C(\tau^{NC}) - \omega^{NC}(\tau^{NC}))$.□

Proposition 7:

From direct observation of $\omega^C(\tau^c)$ and $\Omega^C(\tau^c)$ it is obvious that for both $g = \alpha^L, \lambda^L$ we have $d\omega^C(\tau^c)/dg = d\Omega^C(\tau^c)/dg = 0$.

To show that increases in α^L or λ^L increase the most cooperative multilateral tariff that was self-enforcing at the initial values of α^L or λ^L it is sufficient to show that $d\omega^{NC}/dg < 0$ and $d\Omega^{NC}/dg > 0$.

$$\begin{aligned}
\frac{d\omega^{NC}}{dg} &= \frac{\partial \omega^{NC}}{\partial g} \\
&= \frac{\partial}{\partial g}(W^{Le^S = e^B(\tau^{NC})} - W^{Le^S = e^B(\tau^{NL})}) \\
&= \frac{\partial}{\partial g}(H^L \alpha^L \lambda^L \Psi(b^S H^S e^B(\tau^{NC})) - H^L \alpha^L \lambda^L \Psi(b^S H^S e^B(\tau^{NL}))) \\
&= H^L \lambda^L (\Psi(b^S H^S e^B(\tau^{NC})) - \Psi(b^S H^S e^B(\tau^{NL}))) < 0
\end{aligned}$$

The first equality follows from the fact that if the initial LSPTA is duty-free then, at a given τ^{NC}, both τ^L and e^B are not affected by increase in either α^L or λ^L. Therefore, increases in α^L or λ^L have only a direct effect on ω^{NC}. After plugging in the definitions of ω^{NC} and W^{Le^S}, it is simple to show the final inequality holds since, under a duty-free LSPTA, lowering the threat, from τ^{NL} to τ^{NC}, implies that $e^B(\tau^{NC}) < e^B(\tau^{NL})$ (see lemma 2 in the proof of proposition 6).

Similarly, $d\Omega^{NC}/dg = \partial\Omega^{NC}/\partial g = \partial(W^{Le^S = e^B(\tau^{NL})} - W^{Le^S = e^B(\tau^{NC})})/\partial g = -\partial\omega^{NC}/\partial g > 0$. □

Proposition 10:

When $\delta^L \leq \delta^{LC}$ then $\Omega^C(\tau^C) = \frac{\delta^{LC}}{1-\delta^{LC}}\omega^C(\tau^C)$ at the commitment solution.

When $\delta^S = 0$ the LSPTA's only self-enforcing equilibrium is $e^B = 0,\ \tau = \tau^T$ for all τ^T. In this case Large's problem in the first stage under a LSPTA exception is the same as under commitment except for the IC which is more stringent under the exception. Therefore Large maximizes its welfare under a LSPTA exception by setting $\tau^L = \tau^{mfn} = \tau^{NC}$, the lowest self-enforcing tariff under a LSPTA exception. As we show in proposition 6 at the commitment solution IC^{NC} does not hold if IC^C binds so we have that at the optimum:

$$\bar{W}^C(\tau^C) > \bar{W}^{NC}(\tau^B(\delta^S)\ , e^B(\delta^S), \tau^{NC}(\delta^S))|_{\delta^S = 0}$$

The independence of $\bar{W}^C(\tau^C)$ from δ^S is obvious because LSPTAs are ruled out under commitment.

To see that there exists a $\delta^S = \bar{\delta}^S > 0$ s.t. $\bar{W}^C(\tau^C) \geq \bar{W}^{NC}(.)|_{\delta^S=\bar{\delta}^S}$ we must show that $\bar{W}^{NC}$ is continuous from the right at $\delta^S = 0$. Note that, at the optimum (i.e. when $W^L + W^{L^*}$ is maximized s.t. $\Omega^{NC} = \frac{\delta^L}{1-\delta^L}\omega^{NC}$) an increase in δ^S changes $\bar{W}^{NC}$ only via its effect on the LSPTA variables (according to an envelope argument). Therefore, since the Lagrangian is continuous in τ^B, e^B, we will simply show that τ^B, e^B are continuous as $\delta^S \to 0^+$. That is, as $\delta^S \to 0^+$ we have $\tau^L = \tau^B \to \tau^{NC} = \tau^B(\delta^S = 0)$ and $e^S = e^B \to 0 = e^B(\delta^S = 0)$.

When $\delta^S \to 0$ the LSPTA solution must be given by either τ^{BI} or τ^{BII} since changes in δ^S do not affect the slope of Large's iso-IC nor iso-welfare. If the solution is given by τ^{BII} then: $e^B = \frac{\delta^S}{k}(\tau^{NC} - \tau^B)$, $\tau^{NC} - \tau^B = \frac{\delta^L k}{H^S} H^L \alpha^L \lambda^L \Psi(b^S H^S e^B)$. When $\delta^S \to 0^+$ the solution is:

$$\begin{aligned} e^B &= \lim_{\delta^S \to 0^+} \frac{\delta^S}{k} \frac{\delta^L k}{H^S} H^L \alpha^L \lambda^L \Psi(b^S H^S e^B) \\ &= 0 = e^B(\delta^S = 0) \end{aligned}$$

where we use the fact that $\Psi'(0) - > \infty$.

$$\begin{aligned} \tau^{NC} - \tau^B &= \lim_{\delta^S \to 0^+} \frac{\delta^L k}{H^S} H^L \alpha^L \lambda^L \Psi(b^S H^S e^B(\delta^S)) \\ &= \frac{\delta^L k}{H^S} H^L \alpha^L \lambda^L \Psi(b^S H^S \lim_{\delta^S \to 0^+} e^B(\delta^S)) \end{aligned}$$

which requires that $\tau^B = \tau^{NC} = \tau^B(\delta^S = 0)$.

If the solution is given by τ^{BI} then: $e^B = \frac{\delta^S}{k}(\tau^{NC} - \tau^B)$, $\frac{W^L_{e^S}(e^B)}{W^L_{\tau^L}} = \frac{W^S_{e^S}}{W^S_{\tau^L}} \frac{1}{\delta^S} \frac{W^L_{e^S}(e^B)}{W^L_{\tau^L}} = \lim_{\delta^S \to 0^+} \frac{W^S_{e^S}}{W^S_{\tau^L}} \frac{1}{\delta^S}$ so we must have $W^L_{e^S}(e^B) \to \infty$ for the equality to hold and this requires that $\lim_{\delta^S \to 0^+} e^B(\delta^S) = 0$, since $\Psi'(0) - > \infty$. This in turn implies that $\tau^B \to \tau^{NC}$ since we know that $\tau^{NC} - \tau^B$ is bounded. $\square$