Import tariffs, export subsidies and the theory of trade agreements*

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Abstract

Virtually all the existing models of trade agreements determine only the amount of net trade protection in a given sector, not the *levels* of import tariffs and export subsidies. In this paper we argue that it is important to understand how the levels of these policy instruments are determined by trade agreements, and propose a model that may help us to make some progress in this direction. Our model introduces two new features into an otherwise fairly standard political-economy model of trade agreements: (i) trade agreements can be incomplete, in the sense that agreements can specify *maximum* tariffs and export subsidies (ceilings) rather than *exact* trade policy commitments; (ii) there may be lobbying both when the agreement is negotiated ("ex-ante lobbying") and when governments choose trade policies subject to the constraints imposed by the agreement ("ex-post lobbying"). We show that, if ex-ante lobbying is weaker than ex-post lobbying, tariff and subsidy ceilings are the preferred form of agreement; and when ceilings are used, the optimal levels of tariffs and subsidies are pinned down. Focusing on this case, we identify conditions under which the agreement lowers *both* import tariffs and export subsidies relative to their noncooperative levels, and we examine how the optimal tariff and export subsidy levels depend on the exogenous parameters.

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1. Introduction

The theory of trade agreements is at least half a century old, but it does not have much to say about the levels of import tariffs and export subsidies that are selected by trade agreements. Let us be more precise about this apparently paradoxical statement. Consider a "standard" two-country, static model of trade agreements, where each government maximizes some objective function (not necessarily welfare). If there are at least three goods, such a model can only determine the amount of *net* trade protection in each sector, that is the difference or ratio between the import tariff and the export subsidy. This class of models has nothing to say about the *levels* of the agreed-upon trade policies. In fact, this indeterminacy issue concerns most trade agreement models that we are aware of, including dynamic models.[1,2]

Why should we be interested in the determination of import tariffs and export subsidies, rather than only in net protection? Casual observations suggest that trade negotiatiors and policy makers care a great deal about the levels of tariffs and subsidies, not just net protection levels. Moreover there is a clear empirical regularity in the way that real trade agreements change tariffs and subsidies: when an agreement liberalizes trade in a given sector, it is always through a reduction of tariffs and/or subsidies; we are not aware of any agreement that raised the level of a tariff or of a subsidy. The existing models of trade agreements are simply not able to explain this regularity. In this paper we try to make some progress in this direction.

Our model builds on the strand of political-economy models a' la Grossman and Helpman (1995) by adding two new features: (i) We allow trade agreements to be incomplete, in the sense that agreements specify tariff and export subsidy ceilings, rather than exact trade policy commitments. (ii) Governments and lobbies interact in two stages: at the stage of negotiating the agreement ("ex-ante lobbying"), and later on, at the stage of selecting trade policies subject to the constraints imposed by the agreement ("ex-post lobbying"). The combination of these two features is what pins down the levels of import tariffs and export subsidies in our model.

Our baseline model focuses on two countries and a single sector, assuming that both the import-competing interests and the export interests are politically organized. In a later section we examine the case in which only one of the two relevant interest groups is organized. The baseline model also assumes that governments have zero bargaining power in their dealings with the respective domestic lobbies; in the final part of the paper we relax this assumption.

A key parameter of the model (δ) captures the strength of ex-ante lobbying relative to ex-post lobbying; δ is lower than one when the weight of lobby profits relative to welfare considerations at the ex-ante stage is lower than at the ex-post stage. The most interesting

[1] A very incomplete list includes Johnson (1954), Mayer (1981), Grossman and Helpman (1995), and Bagwell and Staiger (1999). Note that, with the exception of Grossman and Helpman (1995), these models assume *two* goods, hence the trade tax levels are determined, but if these models were extended to allow for more than two goods then trade tax levels would be undetermined.

[2] Note that there exists an additional source of indeterminacy in trade policy models, which is akin to the usual indeterminacy of the general price level: if there are N goods, there are N-1 relative prices, and hence N-1 trade taxes are sufficient to control relative prices. This degree of freedom is usually used up in trade policy models by assuming that the numeraire good is untaxed. This level of indeterminacy is theoretically not very interesting – what we examine in this paper is a *further* layer of indeterminacy, which can be thought of as indeterminacy of "relative" trade taxes.

results of our paper arise when ex-ante lobbying is (even slightly) weaker than ex-post lobbying, i.e. $\delta < 1$. This may be the case if lobbies are more shortsighted than governments, or if political contributions have more influence on day-to-day policy decisions than on the negotiation of trade agreements. We will show that, if $\delta < 1$, it is preferable to write an incomplete agreement that sets only ceilings for tariffs and subsidies, rather than one that specifies exact trade policy commitments. And when ceilings are used, the optimal levels of tariffs and subsidies are pinned down.

The intuition for this result is simple. When the agreement is complete, it automatically shuts down ex-post lobbying, since the exact levels of the trade instruments are determined at the time of the agreement. If the agreement leaves some discretion to governments, however, this discretion may invite ex-post lobbying. For example, if the agreement only sets a maximum tariff level, in the ex-post stage lobbies will have an incentive to offer contributions to persuade the government to raise the tariff all the way to the ceiling. If $\delta < 1$, so that governments have more influence than the lobbies on the determination of the agreement, then ex-post contributions are desirable from the ex-ante point of view, and hence an incomplete agreement may be preferable.

The other key point to understand is that when the agreement entails tariff and subsidy ceilings, the absolute levels of these ceilings matter – not only their difference – so they are uniquely determined by the optimal agreement. Intuitively, if one raises the tariff and subsidy ceilings by the same amount, so that their difference is unchanged, governments have stronger threat points vis-á-vis their domestic lobbies, and hence they are able to elicit higher contributions ex post. Since ex-post contributions matter from the ex-ante point of view, so do the ceiling levels.

We emphasize that both new features of the model are necessary to break the indeterminacy of trade tax levels: the incompleteness of agreements and the feature that ex-ante and ex-post lobbying may differ in strength. If the agreement is complete *or* if ex-ante and ex-post lobbying are equally strong, only net protection matters.

Our following step is to characterize the optimal agreement, focusing on the case $\delta < 1$, so that the agreement takes the form of trade policy ceilings and the ceiling levels are determined. We find that, if the noncooperative equilibrium features positive import tariffs and export subsidies,[3] then the optimal agreement leads to weakly lower tariff and subsidy levels relative to the noncooperative equilibrium. Moreover we find that the reduction in tariff and subsidy levels is *strict* if δ is not too low. On the other hand, if δ is very low (ex-ante lobbying is very weak) it is possible that the optimal agreement entails *no* change relative to the noncooperative policies, or in other words there is no role for a trade agreement. This is in spite of the fact that the fundamentals of the model are essentially the same as in more standard models such as Grossman and Helpman (1995), except that ex-ante lobbying may be weaker than ex-post lobbying (i.e., $\delta < 1$). We also find that trade liberalization deepens as δ increases towards one. In particular, as δ increases the tariff falls faster than the export subsidy, therefore also net trade protection decreases.

The result that stronger ex-ante lobbying tends to favor trade liberalization may appear

[3] This requires that political pressures be sufficiently important, otherwise the noncooperative policy on the export side is an export tax.

counterintuitive at first, but at a closer look it is not hard to understand. The key point is that the preference for ex-post contributions increases as ex-ante lobbying becomes weaker. Since ex-post contributions are higher when the ceiling levels are higher, weaker ex-ante lobbying tends to favor higher ceiling levels. Reasoning along these lines it is also easy to understand why there may be no trade liberalization at all if δ is low. If ex-ante lobbying is weak, then the preference for ex-post contributions is high, so there may be no incentive for trade liberalization, since the gains from increased efficiency may not compensate the losses in terms of reduced contributions.

After analyzing the baseline case in which governments have zero bargaining power vis-á-vis their respective lobbies, we extend the model to allow for more general bargaining powers and show that the qualitative results derived under the assumption of zero bargaining power continue to hold in this more general setting. Looking at the comparative-static effect of a change in the relative bargaining power reveals that trade liberalization is less deep when governments have more bargaining power.

Our final step is to examine how the qualitative results change under alternative lobbying structures, and in particular when only one of the two relevant interest groups is politically organized. The most interesting change in results concerns the case in which only import-competing interests are organized. In this case we find that the comparative-statics effect of a change in δ may get reversed: increasing the strength of ex-ante lobbying may reduce the extent of trade liberalization. The reason is that, when the lobbying pressures from the import-competing side are not matched by pressures from the exporting side, the noncooperative equilibrium entails a high level of net import protection, and hence the import-competing lobby is willing to pay large contributions ex-ante to oppose trade liberalization.

This is the first model (to our knowledge) that characterizes the optimal levels of import tariffs and export subsidies in trade agreements. The existing models of trade agreements either characterize only the amount of net protection, or they characterize the level of a single trade instrument (import tariff or export tax/subsidy) by assuming away the other. The reader can refer to footnote 1 for some standard references on the existing models of trade agreements.

A paper that is somewhat related to ours is Bagwell and Staiger (2005). The point of contact is that their paper proposes an explanation for the use of tariff ceilings in trade agreements. The explanation they propose however is very different from ours: in their model, tariff ceilings are motivated by the presence of privately observed shocks in the political pressures faced by governments.

Maggi and Rodríguez-Clare (2005) consider a model where tariff ceilings are desirable for similar reasons as in the present paper. However the focus of that paper is very different: the purpose there is to develop a model where trade agreements are motivated by domestic-commitment issues (in addition to the standard terms-of-trade externalities) and argue that such a model can help explain a number of stylized facts that the standard terms-of-trade model cannot explain. In the present paper, trade agreements are motivated exclusively by the usual terms-of-trade externalities.[4]

[4] Ornelas (2004) studies a political economy model of trade agreements where governments discount the future because of uncertainty about their re-election prospects. The point of contact with our paper is that he distinguishes between ex-ante lobbying and ex-post lobbying. The focus of his paper however is very different than ours.

The remainder of the paper is organized as follows. In section 2 we present the indeterminacy result, showing that it is a very general feature within the class of static models of trade agreements. In section 3 we propose a simple model of trade agreements under lobbying pressures that combines the possibility of incomplete agreements with the possibility of ex-post lobbying, and we present our main results. In section 4 we extend the model to allow for more general bargaining powers. In section 5 we consider the implications of different lobbying structures. Section 6 concludes.

2. The Indeterminacy Benchmark

Here we argue that the indeterminacy of trade tax levels is a very general feature of *static* models of trade agreements. Consider two perfectly competitive economies with N commodities. We assume that all commodities are traded, but the argument can be easily extended to allow for nontraded commodities. There are M citizens in Home and M^* in Foreign. We take good 1 to be the numeraire. Let $\mathbf{p}$, $\mathbf{p}^*$ and $\mathbf{p}^W$ denote respectively the vectors of domestic, foreign and international (relative) prices. Given that there are $N-1$ relative prices, it suffices to consider $N-1$ trade taxes for each country. Without loss of generality we can take the numeraire good to be the untaxed good in each economy. Assuming that trade taxes are of the specific kind, the following price relationships hold, provided trade taxes are nonprohibitive:

$$p_i = p_i^W + t_i, \; i = 2, ..., N \tag{2.1}$$
$$p_i^* = p_i^W + t_i^*, \; i = 2, ..., N \tag{2.2}$$

Using these relationships in the market clearing conditions one can find the equilibrium prices given trade taxes. We assume that these equilibrium prices are unique and denote them in compact form by $\mathbf{p}(\mathbf{t}, \mathbf{t}^*)$, $\mathbf{p}^*(\mathbf{t}, \mathbf{t}^*)$ and $\mathbf{p}^W(\mathbf{t}, \mathbf{t}^*)$.

Each government maximizes an arbitrary Bergson-Samuelson social welfare function

$$\Omega = F(U_1(\mathbf{p}, I_1), ..., U_M(\mathbf{p}, I_1))$$
$$\Omega^* = F^*(U_{1^*}(\mathbf{p}^*, I_{1^*}), ..., U_{M^*}(\mathbf{p}^*, I_{M^*}))$$

where $U_j(\mathbf{p}, I_j)$ is the indirect utility of the jth individual, which depends on the vector of domestic prices and on the individual's income I_j. Notice that an individual's income will in general include a share of (positive or negative) revenue from trade taxes. Analogous notation applies to the foreign country. These objective functions allow for any kind of distributional and political-economy considerations. We can rewrite these objective functions in more compact form as

$$\Omega(\mathbf{p}, R(\mathbf{p}, \mathbf{p}^W))$$
$$\Omega^*(\mathbf{p}^*, R^*(\mathbf{p}^*, \mathbf{p}^W))$$

where $R = \sum_{i=2}^{N}(p_i - p_i^W)m_i$ denotes the revenue (positive or negative) from trade taxes in Home, and R^* is defined analogously (m_i stands for the volume of imports by Home of good i). This notation emphasizes that, holding local prices constant, a change in international prices affects the objective only through revenue. Also note that there is no loss of generality in assuming that revenue enters Ω only through its aggregate amount, as long as Ω is interpreted as the maximum value of $F()$ that can be attained given total revenue R.

Given these assumptions, there exists a set of feasible payoffs for the two governments, which we denote $\mathbf{V}$. This is a set in space (Ω, Ω^*). Any payoff pair in $\mathbf{V}$ can be achieved by some vector of trade taxes. The standard way to think about a trade agreement is to assume some bargaining process or mechanism that selects a point in the feasible payoff set, and hence a vector of trade taxes.

To make our point we do not need to make any assumption on the mechanism by which the agreement is selected. We will simply argue that each payoff pair in $\mathbf{V}$ can be achieved by many different trade tax vectors, hence there is a deep indeterminacy that holds regardless of the agreement selection mechanism.

The following proposition states the result:

Proposition 1. *In the "static" model of trade agreements, if $N \geq 3$ the vector of trade taxes is indeterminate. If international transfers are available, the indeterminacy result holds also if $N = 2$.*

Proof: Consider first the case in which transfers are not available. Consider a vector of trade taxes $(\mathbf{t}^0, \mathbf{t}^{*0})$. Let $(\mathbf{p}^0, \mathbf{p}^{*0})$ denote the associated local price vectors and (Ω^0, Ω^{*0}) the implied values of the government objectives. We now argue that there exist many other trade tax vectors that yield the same values (Ω^0, Ω^{*0}). Let us construct one. Pick one good that is imported by Home, say good 2, and a good that is imported by Foreign, say good 3. Consider increasing both t_2 and t_2^* by the same amount, say Δ_2. At the initial prices, $(\mathbf{p}^0, \mathbf{p}^{*0})$, this increases R by the amount $\Delta_2 m_2^0$ and decreases R^* by the same amount (where m_2^0 is the level of imports at the initial prices). Now consider increasing both t_3 and t_3^* by a common amount Δ_3, where Δ_3 is chosen such that

$$\Delta_2 m_2^0 + \Delta_3 m_3^0 = 0$$

It is easy to check that, given the new trade tax vector, the initial prices still clear the market, and revenues are the same in each country. This implies that the values of the objectives are the same as before, (Ω^0, Ω^{*0}).

Applying the same logic as above one can show that, if transfers are available, the indeterminacy result holds also if $N = 2$. **QED**

The indeterminacy highlighted in the previous proposition is multidimensional: it is easy to see that there are $N - 2$ degrees of freedom (and if there are international transfers, the degrees of freedom are $N - 1$). The reason is that, in *each* of the $N - 1$ nonnumeraire sectors, trade taxes can be adjusted in such a way as to leave the allocation unchanged and make a pure transfer from one country to the other.

Note that if $N = 2$ and there are no international transfers, there is no indeterminacy. This is the reason why the indeterminacy problem does not appear in models such as Mayer (1981) and Bagwell and Staiger (1999). An example of a multi-good model where the indeterminacy issue does arise is Grossman and Helpman (1995). In that model, a trade agreement determines only the ratio between the domestic and foreign (ad-valorem) trade taxes in each sector.

Also note that there is an additional source of indeterminacy in this model, which is analoguous to the Lerner symmetry theorem: we have assumed that the numeraire good is not taxed, but we could have chosen any other good as the untaxed good. This additional level of indeterminacy is a corollary of the usual indeterminacy of the general price level. What we emphasize here is a further layer of indeterminacy, which can be thought of as indeterminacy of "relative" trade taxes.

It is important to highlight that, in contrast with cooperative trade policies, which are indeterminate, *noncooperative trade policies are typically determinate.* A Nash equilibrium in trade policies is a vector $(\mathbf{t}^N, \mathbf{t}^{N^*})$ such that

$$\mathbf{t}^N \in \arg\max_{\mathbf{t}} \Omega(\mathbf{p}(\mathbf{t}, \mathbf{t}^*), R(\mathbf{p}(\mathbf{t}, \mathbf{t}^*), \mathbf{p}^W(\mathbf{t}, \mathbf{t}^*)))$$
$$\mathbf{t}^{N^*} \in \arg\max_{\mathbf{t}^*} \Omega^*(\mathbf{p}^*(\mathbf{t}, \mathbf{t}^*), R^*(\mathbf{p}^*(\mathbf{t}, \mathbf{t}^*), \mathbf{p}^W(\mathbf{t}, \mathbf{t}^*)))$$

Under some conditions the Nash equilibrium is unique, and even if there are multiple Nash equilibria, the number of equilibria is generally "small" (i.e., the measure of the equilibrium set is zero), whereas there is "deep" indeterminacy in the case of cooperative trade policies (i.e., the equilibrium set has positive measure). The reason for this difference is that in the non-cooperative case what matters is the incentives of governments to deviate. These incentives do not depend on domestic prices and net transfers, which are the essential variables in the cooperative solution, but rather on the actual levels of tariffs and export subsidies: everything else equal, higher tariffs and subsidies implies higher incentives for the importing country to lower the tariff, since the increase in imports would imply a larger increase in transfers from the exporter to the importer country.

3. A simple alternative model

Here we propose a simple political economy model that can explain the levels of trade taxes implemented by a trade agreement. Our modeling strategy is the opposite as in the previous section: rather than considering a very general model, we focus on the simplest possible model to illustrate how the levels of trade taxes may matter for a trade agreement.

3.1. The economic structure

There are two countries, Home and Foreign, and two goods, N and M. Here we assume that international transfers are available, but we could make the same points with a model that has more than two goods and no transfers. To keep the model as simple as possible we assume that each good is produced one-for-one from a specific factor. Focusing on the Home economy, we let x denote the supply of the M-specific factor and q the supply of the N-specific factor. Asterisks will denote foreign variables.

We assume that citizens in both countries have the following quasi-linear preferences:

$$U = c_N + vc_M - c_M^2$$

If the supply of the N good is large enough that $c_N > 0$ in equilibrium – a condition that we assume henceforth for both countries – the demand function for good M is given by

$$d(p) = v - p$$

We make Home the natural importer of good M by assuming that it has a smaller supply of the M-specific factor: $x < x^*$; the two countries are identical in all other respects. Under this condition, in the free trade equilibrium Home imports good M.

Home chooses a specific import tariff t (import subsidy if negative) and Foreign chooses a specific export subsidy t^* (export tax if negative). Domestic prices are given by

$$\begin{aligned} p &= p^w + t \\ p^* &= p^w + t^* \end{aligned}$$

where p^w is the international price.

The market clearing condition for sector M is

$$d(p) + d(p^*) = x + x^*$$

This yields

$$p^w = v - \frac{1}{2}(x + x^* + t^* + t)$$

Letting m denote imports of the home country, then:

$$\begin{aligned} m &\equiv d(p) - x \\ &= \frac{1}{2}(\Delta x + t^* - t) \end{aligned}$$

where $\Delta x = x^* - x$. The welfare functions (i.e., utility of the representative agent) are:

$$\begin{aligned} W &= q + px + tm + s \\ W^* &= q^* + p^* x^* - t^* m + s^* \end{aligned}$$

where s and s^* denote respectively consumer surplus in Home and Foreign.

3.2. The political structure

We model lobbying in a similar way as in Grossman and Helpman (1994). In each country, the owners of the specific factor in the M sector are organized as a lobby and give contributions to their government in exchange for protection. We assume that the numeraire sector is not politically organized in either country.

The objective functions of the two governments are respectively given by

$$\begin{aligned} U^G &= aW + C \\ U^{G*} &= aW^* + C^* \end{aligned}$$

where C and C^* represent contributions in the two countries.

Assuming that in each country the owners of the specific factor in the M sector are a small fraction of the population, each lobby maximizes total returns to the specific factor minus contributions:

$$\begin{aligned} U^L &= px - C \\ U^{L^*} &= p^* x^* - C^* \end{aligned}$$

We assume that in each country the government and the lobby bargain efficiently over the tariff and contributions. In this basic model we assume that the lobby has all the bargaining power. An equivalent assumption would be that the lobby makes a take-it-or-leave-it offer to the government that consists in a trade tax level and a contribution level. In a subsequent section we will extend the analysis to allow for any relative bargaining power.

3.3. The noncooperative equilibrium

We first characterize the equilibrium of the game in which the two countries choose trade policies in the absence of a trade agreement, or using the Grossman-Helpman terminology, the "trade war" equilibrium. Formally, we define a *noncooperative equilibrium* as a vector of trade policies and contributions, (t, t^*, C, C^*) such that (i) (t, C) is the outcome of the Nash bargaining game in Home given t^*, and (ii) (t^*, C^*) is the outcome of the Nash bargaining game in Foreign given t.

We will often refer to the home government and lobby as if they were a single player, labeling it GL, and similarly we will use the label G*L* for the Foreign government and lobby. Given t^* and C^*, GL chooses t to maximize

$$J = aW + px$$

This yields

$$t = R_m(t^*) = (1/3)(t^* + \Delta x + 2x/a) \tag{3.1}$$

The first two terms in the parenthesis represent the terms-of-trade motivation for protecting the import-competing industry: a higher Δx or a higher t^* implies a higher import volume, and this invites a higher tariff to improve terms of trade. The third term, proportional to x/a, captures the "political" motive for protection. It decreases with a, the importance of welfare considerations in the government objective. For future reference let us derive the tariff that a welfare-maximizing government would impose, or equivalently the political equilibrium tariff as $a \to \infty$, which we denote $R_m^W(t^*)$. This is given by:

$$R_m^W(t^*) \equiv (1/3)(t^* + \Delta x)$$

As mentioned above, the tariff $t = R_m(t^*)$ is the one that maximizes the joint surplus of Government and Lobby in the home country given t^*. But since this tariff is not the one that maximizes welfare (i.e., $R_m(t^*) \neq R_m^W(t^*)$), contributions are necessary to induce the Government to choose $t = R_m(t^*)$. In particular, contributions must satisfy

$$\begin{aligned} C &= a[W(R_m^W(t^*), t^*) - W(R_m(t^*), t^*)] & (3.2) \\ &= (3a/8)\left(R_m(t^*) - R_m^W(t^*)\right)^2 = x^2/6a & (3.3) \end{aligned}$$

Turning now to the Foreign country, G*L* choose t^* given t to maximize

$$J^* = aW^* + p^*x^*$$

This yields the noncooperative export policy given t :

$$t^* = R_x(t) = (1/3)(t - \Delta x + 2x^*/a) \tag{3.4}$$

with underlying contributions given by:

$$C^* = (3a/8)\left(R_x(t) - R_x^W(t)\right)^2 = x^{*2}/6a$$

Again, we can decompose the noncooperative optimal export policy $t^* = R_x(t)$ into a terms-of-trade motivated export *tax*, equal to $(1/3)(\Delta x - t)$, and a politically-motivated export *subsidy* given by $2x^*/a$. Note that, for there to be positive exports, it must be that $t < \Delta x$, so in the relevant range the first component is indeed an export tax. If political considerations are relatively important, i.e. if a is relatively low, the noncooperative export policy is an export subsidy, otherwise it is an export tax. For future reference we define the welfare-maximizing export policy, which is the limit of R_x as $a \to \infty$:

$$R_x^W(t) \equiv (1/3)(t - \Delta x)$$

The noncooperative equilibrium policies must satisfy conditions 3.1 and 3.4, therefore they are given by

$$\begin{aligned} t^N &= (1/4)(\Delta x + x^*/a + 3x/a) \\ t^{*N} &= (1/4)(-\Delta x + 3x^*/a + x/a) \end{aligned}$$

Note that the export subsidy t^{*N} is positive iff

$$a < \frac{3x^* + x}{\Delta x}$$

Again, the intuition is that if a is small, political considerations dominate terms-of-trade considerations, and hence the forces that push toward export subsidies dominate the forces that push toward export taxes.[5]

[5] One can check that imports are positive in the Nash equilibrium. Recall that $m = \Delta x + t^{*N} - t^N > 0$, hence imports are positive as long as $\Delta x > t^N - t^{*N}$. Given that $t^N - t^{*N} = \left(\frac{a-1}{a}\right)(\Delta x/2)$ then this condition is always satisfied.

Also note that net protection, $t^N - t^{*N}$, is given by

$$t^N - t^{*N} = \left(\frac{a-1}{a}\right)(\Delta x/2)$$

Thus net protection is positive if the government values welfare more than contributions ($a > 1$), and negative otherwise. Intuititively, terms of trade considerations lead towards policies that restrict trade (i.e., positive net trade protection), whereas political considerations lead to trade expansion because - given symmetry in preferences and no transport costs - exporting sectors are larger and hence (*ceteris paribus*) politically more powerful (see Levy, 1999). The condition $a > 1$ is precisely the condition that guarantees that terms of trade considerations dominate political considerations and hence that the equilibrium entails net trade protection and less trade relative to free trade.

3.4. The optimal agreement

We think of a trade agreement as imposing constraints on the governments' choice of trade policies. At the time of the agreement, governments select these (perfectly enforceable) constraints subject to pressures from their respective domestic lobbies (this is what we call *ex-ante* lobbying). After the agreement is signed, governments choose trade policies subject to the constraints imposed by the agreement, and at this stage lobbying can take place again (*ex-post* lobbying). The game played by governments and lobbies after the agreement is signed is similar to the game analyzed in the previous section, except that policies are subject to the constraints determined by the agreement.

We need to be specific about how the agreement is selected. We take a simple reduced-form approach and assume that the agreement maximizes the ex-ante joint surplus of the two governments and the two lobbies. To capture the strength of ex-ante lobbying, we weigh the lobbies' part of the joint surplus with a parameter δ, so that joint surplus is $\psi = U^G + U^{G^*} + \delta(U^L + U^{L^*})$, or

$$\psi = aW + C + aW^* + C^* + \delta(px - C + p^*x^* - C^*) \tag{3.5}$$

The payoffs of players in the above expression are interpreted as the second-period (ex-post) payoffs as viewed from the ex-ante stage. In particular, C and C^* are the contributions paid in the ex-post stage of the game. The case $\delta = 1$ corresponds to the benchmark case in which ex-ante lobbying is just as strong as ex-post lobbying. When $\delta < 1$, the influence of the lobbies on the selection of the agreement is weaker than their influence on the selection of policies in the ex-post stage, and viceversa if $\delta > 1$.

We can offer two interpretations of δ in terms of more fundamental parameters. One possible interpretation of δ is simply as the discount factor of the lobbies relative to that of the governments. The way a government discounts the future depends on factors such as the probability of re-election, and the way a lobby discounts the future depends on factors such as the probability of bankruptcy.[6] Another possible interpretation of δ is the following. Suppose governments and lobbies discount the future in the same way, but the influence of contributions

[6] One simple way to derive δ from more fundamental parameters would be the following. Suppose that the government is simply a leader, say a president, and there is a probability $1 - \delta^G$ that tomorrow he will be out

on day-to-day policy choices may be different than their influence on the negotiation of an agreement.[7] This idea can be captured by writing the home government's ex-ante objective as $U^G_{ex-ante} = U^G + \delta C_{ex-ante}$, and analogously for the foreign government. Here δ captures the weight attached to ex-ante contributions, which can be different from that of ex-post contributions. The domestic lobby's ex-ante objective can be written as $U^L_{ex-ante} = U^L - C_{ex-ante}$ (and analogously for the foreign lobby). Multiplying the lobbies' objectives by δ to make utility ex-ante transferable, and summing up, the ex-ante joint surplus can then be written as in (3.5).

We consider two types of agreement: agreements that specify exact trade policy commitments (i.e., equality constraints of the type $t = \bar{t}$), and agreements that specify ceilings for tariff and export subsidies (i.e., inequality constraints of the type $t \leq \bar{t}$). The former type of agreement is a complete contract, while the latter is an incomplete contract that leaves some discretion to governments.

Let us focus first on complete agreements. In this case, after the agreement is signed, there is no room for further political interaction between governments and lobbies, therefore the political game effectively ends with the agreement. In other words, complete agreements effectively shut down any ex-post lobbying, so that there are no contributions ex-post. In the case of *ceilings*, on the other hand, a government has some discretion in determining trade policy after the agreement is signed. In particular, a government can credibly threaten to impose its unilateral best policy given the policy adopted by the other government ($R^W_m(t^*)$ for the home government, $R^W_x(t)$ for the foreign government), so the lobby has to compensate the government for deviating from this policy. In this case, there may be positive contributions ex-post.

The "standard" models of trade agreements typically ignore the possibility of ex-post lobbying and of incomplete agreements. If one assumes away ex-post lobbying, there is no need to consider incomplete agreements, and if one assumes complete agreements there is no ex-post lobbying to talk about, but making these two assumptions *jointly* is restrictive. As we will see, if one allows at the same time for incomplete agreements and ex-post lobbying, the predictions of the model can change considerably.

As a first step, however, it is useful to characterize the optimal complete agreement, as this will establish a link with the literature and also serve as a benchmark against which to analyze incomplete agreements.

Complete agreements

Complete agreements are easy to characterize because, as explained above, they induce no

of office, in which case he will become a regular citizen and will care about welfare. Then his expected payoff for the next period is $\delta^G(aW + C) + (1 - \delta^G)aW = aW + \delta^G C$. Also suppose that there is a probability δ^L that each lobby member will go bankrupt tomorrow (i.e., his unit of capital depreciates completely). Then the lobby's aggregate expected payoff for the next period is $\delta^L(px - C)$. The joint surplus of the governments and lobbies is therefore $a(W + W^*) + \delta^L(px + p^*x^*) + (\delta^G - \delta^L)(C + C^*)$. Dividing this expression by δ^G one gets $(a/\delta^G)(W + W^*) + \delta(px + p^*x^*) + (1 - \delta)(C + C^*)$, where $\delta \equiv \delta^L/\delta^G$. This expression has the same qualitative structure as the one above (except for the weight on welfare, which suggests that the parameter a we have in the model should be interpreted as incorporating also the government's probability of re-election).

[7] This might be the case for example if trade negotiators care less about campaign contributions than the policymakers in charge of day-to-day policy decisions.

ex-post contributions. The objective function then becomes

$$\psi = a(W + W^*) + \delta(px + p^*x^*) \tag{3.6}$$

From the first order conditions for a maximum (i.e., $\psi_t = 0$ and $\psi_{t^*} = 0$) we obtain

$$\begin{aligned} \frac{a}{2}(t^* - t) + \frac{\delta}{2}(x - x^*) &= 0 \\ \frac{a}{2}(t - t^*) + \frac{\delta}{2}(x^* - x) &= 0 \end{aligned}$$

Clearly these equations are linearly dependent, and only the difference $t - t^*$ is determined. The following proposition records this result:

Proposition 2. *The optimal complete agreement only determines* net *protection, not the levels of* t *and* t^*. *The optimal net protection is given by* $t - t^* = \delta(x - x^*)/a$

This result is similar to the ones that are found in the literature, for example Grossman and Helpman (1995) and Bagwell and Staiger (1999). The interpretation of this result is that the optimal complete agreement allows only for protection motivated by political considerations, not by terms of trade considerations. Trade policies are set *as if* the two countries were small, in which case the optimal trade policies would be respectively $t = \delta x/a$ and $t^* = \delta x^*/a$. The optimality condition defines a line in t, t^* space, that we label the Politically Optimal Line (POL). The levels of trade taxes are indeterminate for the usual reason: increasing t and t^* one-for-one generates a pure transfer from Foreign to Home without affecting the equilibrium allocation.

Note that the optimal level of net protection is negative: $t - t^* = \delta(x - x^*)/a < 0$. This implies that the agreement promotes trade not only relative to the noncooperative equilibrium, but also relative to free trade. This is simply because the agreement eliminates terms of trade considerations, and hence the level of net protection is completely determined by the desire to favor domestic interest groups. Since the exporting sector is larger and politically more powerful, this pushes the agreement in the direction of net trade promotion for any level of a. In other words, although net trade promotion benefits exporters in the foreign country and hurts import-competing producers in the home country, the fact that exporters are a larger group (i.e., $x^* > x$) tilts the agreement in favor of this group and induces trade promotion.

<u>Trade policy ceilings</u>

We now consider agreements that impose constraints of the form $t \leq \bar{t}$ and $t^* \leq \bar{t}^*$, or "ceilings." As explained above, agreements of this type may induce ex-post contributions, thus their implications may be very different from those of complete agreements.

We analyze the game by backward induction. In the second stage, given the ceilings $(\bar{t}, \bar{t}^*)$, the same noncooperative game as in section 3.3 takes place. In the first stage, Governments choose the ceilings $(\bar{t}, \bar{t}^*)$ to maximize the joint surplus 3.5.

We first ask what trade taxes can be implemented by this kind of agreement; this will determine the set of all possible equilibria in the second stage of the game. Given t^*, the tariff levels that can be implemented by a ceiling are those that satisfy $t \leq R_m(t^*)$. This is because, if the ceiling $\bar{t}$ is below $R_m(t^*)$, GL will choose a tariff equal to $\bar{t}$, while if $\bar{t}$ is above $R_m(t^*)$ then GL will choose a tariff equal to $R_m(t^*)$ (the ceiling is not binding). Similarly, given t, the set of export subsidies that can be implemented by a ceiling is given by $t^* \leq R_x(t)$. It follows that the set of implementable trade taxes is given by the pairs (t, t^*) that satisfy $t \leq R_m(t^*)$ and $t^* \leq R_x(t)$. We will refer to this region as the "Cone".

The next step is to explore how the use of ceilings can generate political contributions in the subgame. Focusing on the Cone, it is clear that in the subgame equilibrium trade policies are equal to the ceiling levels: $t = \bar{t}, t^* = \bar{t}^*$. It is then easy to derive C and C^* as functions of the ceilings. Focus first on Home. If $\bar{t} \leq R_m^W(\bar{t}^*)$, ex-post contributions are zero, because the government has no credible threat in the negotiation with the lobby: if $\bar{t} \leq R_m^W(\bar{t}^*)$, the government's best outside option is given by the ceiling level $\bar{t}$ itself. If, on the other hand, $\bar{t} > R_m^W(\bar{t}^*)$, contributions will be positive, because the government's outside option is to impose a tariff lower than $\bar{t}$, namely $R_m^W(\bar{t}^*)$. Thus, if the lobby wants to persuade the government to raise the tariff up to the ceiling level t, it has to compensate the government for the associated welfare loss. Applying the same logic as in the analysis of the noncooperative equilibrium (see equations 3.2) one can show that contributions in this case are given by $C = (3a/8)\left(\bar{t} - R_m^W(\bar{t}^*)\right)^2$. Similarly, if $\bar{t}^* \leq R_x^W(\bar{t})$ contributions for the foreign government are zero, and if $\bar{t}^* > R_x^W(\bar{t})$ they are given by $C^* = (3a/8)\left(\bar{t}^* - R_x^W(\bar{t})\right)^2$. Summarizing:

$$
\begin{aligned}
C &= \begin{cases} 0 & \text{if} \quad \bar{t} \leq R_m^W(\bar{t}^*) \\ (3a/8)\left(\bar{t} - R_m^W(\bar{t}^*)\right)^2 & \text{if} \quad R_m^W(\bar{t}^*) < \bar{t} \leq R_m(\bar{t}^*) \end{cases} \\
C^* &= \begin{cases} 0 & \text{if} \quad \bar{t}^* \leq R_x^W(\bar{t}) \\ (3a/8)\left(\bar{t}^* - R_x^W(\bar{t})\right)^2 & \text{if} \quad R_x^W(\bar{t}) < \bar{t}^* \leq R_x(\bar{t}) \end{cases}
\end{aligned}
\tag{3.7}
$$

We will at times refer to the part of the Cone where contributions are positive in both countries (i.e. the region defined by the inequalities $R_m^W(\bar{t}^*) < \bar{t} \leq R_m(\bar{t}^*)$ and $R_x^W(\bar{t}) < \bar{t}^* \leq R_x(\bar{t})$) as the "Romboid". See Figure 1.

We can now move back to the first stage where the agreement $(\bar{t}, \bar{t}^*)$ is chosen to maximize the ex-ante joint surplus, given by (3.5). Before deriving the optimal ceilings, however, this is a good juncture to compare ceilings with exact commitments (equality constraints). Ceilings have the advantage that they may generate positive contributions, which have positive value in the ex-ante objective (given $\delta < 1$), whereas exact commitments do not generate contributions. On the other hand, exact commitments have a higher implementation power, because they can implement any point in (t, t^*) space, whereas ceilings can only implement points in the Cone. However, it is not hard to see that the higher implementation power of exact commitments is ultimately not useful. Consider an agreement $(t = t_0, t^* = t_0^*)$. Even if the point (t_0, t_0^*) is outside the Cone, we can construct ceilings that perform just as well. As we know already, the agreement $(t = t_0, t^* = t_0^*)$ is equivalent to any other complete agreement that lies on the same 45 degree line, because they all yield the same allocation and zero contributions. Now, if we move down this 45 degree line, eventually we will be in the region where $t \leq R_m^W(t^*)$ and $t^* \leq R_x^W(t)$. But in this region equality constraints are equivalent to ceilings, because contributions are zero in both cases and the allocation is the same. The following proposition states this result formally:

Proposition 3. *Trade policy ceilings perform at least as well as exact trade policy commitments.*

A natural question is under what circumstances ceilings are *strictly* preferred to exact commitments. Although a formal answer must await the characterization of the optimal ceilings, to which we turn next, it is easy to see that if $\delta < 1$ the ex-ante joint surplus of governments and lobbies is increasing in the amount of ex-post contributions, and hence agreements that generate ex-post contributions (other things equal) will be preferred. Below we will confirm this intuition and show that if $\delta < 1$ ceilings are strictly preferred to exact commitments.

We now turn to the characterization of the optimal ceilings. As we argued above, only the points in the Cone can be implemented by ceilings, therefore we can focus on the Cone and ignore the remaining region. Recalling that within the Cone the equilibrium taxes are equal to the ceiling levels ($t = \bar{t}, t^* = \bar{t}^*$), the optimal ceilings are given by the solution to the following problem

$$\max_{\bar{t},\bar{t}^*} \psi = a(W + W^*) + \delta(px + p^*x^*) + (1 - \delta)(C + C^*)$$

where C and C^* are given by 3.7.

The key difference between this problem and problem 3.6 is that now the ex-post contributions C and C^* may be positive. At this point it is intuitive that, when the trade agreement takes the form of ceilings, the indeterminacy of trade tax levels in general is broken. Consider for example two different points inside the Romboid and on the same 45 degree line, say P and P'. Suppose point P is higher, i.e. characterized by higher trade tax levels. If these points are implemented by equality constraints, they are equivalent, because they imply the same allocation and zero contributions, but if they are implemented by ceilings then they are not equivalent, because they imply different contributions. In particular, point P entails higher contributions, because its distance from the curves R_m^W and R_x^W is greater [$(\bar{t} - R_m^W(\bar{t}^*))$ and $(\bar{t}^* - R_x^W(\bar{t}))$ are higher]: intuitively, higher ceiling levels imply that governments have stronger threat points vis-á-vis their domestic lobbies. And since contributions enter positively in the ex-ante objective, point P is preferable to point P'.

Pushing this intuition one step further, one can see that any pair of ceilings in the interior of the Cone can be dominated by moving up along a 45 degree line, hence the optimum must be on the boundary of the Cone. Can it be on the R_m curve? The answer is no, because the ex-ante objective improves if we move up along the R_m curve: the allocation improves, because we get closer to the POL; foreign contributions C^* increase, because we move away from R_x^W; and home contributions C stay constant, because we move parallel to R_m^W. Therefore the optimum must be on the R_x line. Notice that, since the R_x line is increasing, the optimal agreement weakly lowers the import tariff and the export subsidy relative to their noncooperative levels.

The next proposition confirms this intuition, shows that for $\delta < 1$ trade policy ceilings are strictly preferred to exact trade policy commitments, establishes conditions under which the optimal ceilings are *strictly* below the noncooperative levels t^N and t^{*N}, and examines how the optimal agreement varies with δ.

Proposition 4. *If* $\delta < 1$ *then:*
(i) Trade policy ceilings are strictly preferred to exact trade policy commitments.
(ii) The optimal ceilings $(\bar{t}, \bar{t}^*)$ *are unique and satisfy* $\bar{t} \leq t^N$, $\bar{t}^* \leq t^{*N}$. *The inequalities are strict if* $\delta > \hat{\delta}$, *where* $\hat{\delta}$ *is a critical level that satisfies* $0 \leq \hat{\delta} < 1$ *(with* $0 < \hat{\delta} < 1$ *if* $a \leq x^*/\Delta x$*).*
(iii) The optimal ceilings are weakly decreasing in δ. *If* δ *is close to one, the optimal point is close to the intersection between the POL and the* R_x *line (point Q); as* δ *decreases from one, the optimal point moves along the* R_x *line towards point N.*

Proof: See Appendix.

Point (i) of this proposition formalizes a result that we have already discussed intuitively.

Point (ii) states that, if ex-ante lobbying is weaker than ex-post lobbying, the model uniquely determines the optimal trade tax levels. We emphasize that it is the interaction of two features – the incompleteness of the agreement and the difference in strength between ex-ante and ex-post lobbying – that breaks the indeterminacy of trade tax levels. Neither feature alone would break the indeterminacy – only the combination of the two does. If the agreement is complete, it shuts down ex-post lobbying, hence considerations of ex-post lobbying are irrelevant and the indeterminacy remains. And if ex-ante and ex-post lobbying are equally strong ($\delta = 1$), the indeterminacy result remains even if the agreement only imposes ceilings on trade policies.

After establishing uniqueness, the proposition goes on to characterize the optimal agreement. The agreement implements weakly lower levels of t and t^* relative to the noncooperative equilibrium, and if δ lies between the critical levels $\hat{\delta}$ and 1, it leads to *strictly* lower levels of t and t^*.

Note that the critical level $\hat{\delta}$ may be zero, in which case the agreement reduces the import tariff and the export subsidy for any $\delta < 1$. On the other hand, there is a region of parameters for which the optimal agreement coincides with the Nash equilibrium, hence there is *no* role for a trade agreement. The proposition highlights that this will be the case of if $a \leq x^*/\Delta x$ and δ is sufficiently low. This possibility may be surprising because the fundamentals of the model are the same as in the "standard" models a' la Grossman and Helpman (1995), except that ex-ante lobbying may be weaker than ex-post lobbying.

Point (iii) highlights the comparative-static effect of changes in δ. Trade liberalization tends to be deeper when δ is higher, i.e. when ex-ante lobbying is relatively more important. More specifically, if δ is close to one the optimal agreement is close to point Q (intersection of the POL and the R_x line), and as δ decreases from one, the optimal point travels along the R_x line towards the noncooperative point. As δ decreases, the optimal point may or may not reach the noncooperative point, as point (ii) makes clear. We note that, as δ decreases, not only t and t^* increase, but also net trade protection $t - t^*$ increases.

To develop some intuition for these results, recall that the optimal complete agreement entails more trade than the noncooperative equilibrium, so for any δ the POL lies to the left of the noncooperative point. Graphically, this implies that point Q lies southwest of point N along R_x (see Figure 1). Also recall from the discussion before the proposition that the optimal point must be on the R_x line. If $\delta = 1$ then the joint surplus of governments and lobbies is independent of future contributions, and hence the best they can do is to pick an agreement on the POL. If $\delta < 1$, however, the ex-ante joint surplus is increasing with ex-post contributions, so the agreement will seek to increase contributions even if this implies sacrificing efficiency. This entails moving northeast from point Q along the R_x line.[8] If δ is close to one, then ex-post contributions do not matter much ex-ante, and such a deviation from Q will be small, implying that the agreement will have strictly lower tariffs and subsidies than at the non-cooperative equilibrium. But if δ is very low, ex-post contributions matter greatly for the ex-ante joint surplus of governments and lobbies, so there will be a great willingness to sacrifice efficiency to increase contributions ex-post, leading possibly to point N where contributions are maximized. The fact that lower a makes trade liberalization less likely is also intuitive: lower a means that the government attaches more value to contributions, and other things equal this pushes the optimal point in the direction of point N.

Intuition might have suggested another effect that pushes in the opposite direction: lobbies are interested in higher trade protection, and therefore stronger ex-ante lobbying should imply less trade liberalization. The reason this intuition is not correct is that both import-competing interests and export interests are politically organized. In fact, since the exporter lobby is larger, an increase in ex-ante lobbying effectiveness will push towards lower net trade protection. This feature is captured by the fact that, as δ increases, the POL line moves to the left, and hence point Q moves southwest along R_x.

In sum, there are *two* forces that push in the same direction: as δ increases, the POL moves to the left, in the direction of lower net protection; and the optimal point moves closer to the POL, in the direction of lower contributions. We note that this depends on the assumption that both import-competing interests and exporting interests are organized. As we will see in section 5, if only import-competing interests are organized, then the extent of trade liberalization may be *de*creasing in δ.

It is worth emphasizing that, in the limit as δ approaches one, the optimal point approaches the intersection between the POL and the R_x line. The reader will recall that, if $\delta = 1$, our model is equivalent to the "standard" model: only net protection is determined, and any point along the POL line is optimal. Thus, if the standard model is perturbed by lowering δ slightly below one, the indeterminacy of trade tax levels is broken, and the selected point on the POL line is point Q.

We note that, since the optimum is on the R_x curve, the binding on the export subsidy is not necessary to implement the optimal point. It is sufficient to impose a binding on the import tariff, and the political process in the exporting country will naturally lead to the optimal level of the export subsidy. This seems at odds with empirical observations, since real trade agreements impose strict limits on export subsidies. Technically speaking the model is consistent with this observation, because the optimum can be implemented indifferently with or without a cap on t^*, but this is not fully satisfactory because the model does not explain why there might be a strict preference for imposing a limit on export subsidies. This remains an open question for future research.

We assumed linear demand functions and fixed supplies, so it is natural to ask how results would change with more general demand and supply structures. A key result that would not change is that, if $\delta < 1$, the optimal agreement takes the form of ceilings on t and t^* and

[8] Recall that point Q depends on δ, because the POL depends on δ. As δ decreases, point Q moves northeast along R_x, but the optimal point moves faster than Q.

the indeterminacy of trade tax levels is broken. A feature that may change with more general demand and supply functions is that the R_x curve may no longer be upward sloping. If the R_x curve is downward sloping, the optimal agreement may imply a reduction in t and an increase in t^*. Thus, Proposition 4 would have to include conditions that ensure that R_x is upward sloping. We do not believe this is a drawback of the model, since the main value of the proposition is to show that *under some conditions* our model can explain why trade agreements reduce the levels of tariffs and export subsidies. We also note that there is another interesting case in which the R_x curve is upward sloping, namely the case of constant trade elasticities. This has been shown by Grossman and Helpman (1995, pp. 690-694). The reader can refer to figure 2 of their paper.

4. Bargaining powers

It is natural to ask how the results of our model change if governments have bargaining power vis-á-vis their domestic lobbies. In this section we extend the model to address this question.

Assume as in the previous section that in the subgame each government engages in Nash bargaining with its domestic lobby, but now let $\sigma \in [0,1]$ denote the relative bargaining power of the government. As we will show formally below, the only way in which σ affects the analysis is through its impact on the way that contributions are determined. This immediately implies that Propositions 2 and 3 - which do not depend on contributions - continue to hold for any $\sigma > 0$. The same reasoning implies that none of our results for the case with $\delta > 1$ are affected, since in this case the optimal agreement does not entail contributions. Thus, we focus on the case with $\delta < 1$, where incomplete agreements are preferred and where there will be positive contributions ex-post.

Since bargaining is efficient and utility is transferable, σ does not affect the tariffs and subsidies selected by each government-lobby pair *conditional on the ceilings* $(\bar{t}, \bar{t}^*)$. This is because under these circumstasnces σ does not affect the R_x and R_m curves, and hence the position of the "cone" is independent of σ. On the other hand, since σ affects the amount of ex-post contributions, it will affect the selection of the optimal ceilings.

The first step is to derive the ex-post contributions as functions of σ and the ceilings. Let us focus on Home. Given the Nash bargaining assumption, contributions are determined in such a way that the government obtains a share σ of the joint surplus *over the status quo.* Thus we first need to derive this joint surplus. The status quo is given by the outcome where no contributions are paid and the government chooses the tariff that maximizes welfare subject to the binding $\bar{t}$, which is

$$t^{SQ}(\bar{t}, \bar{t}^*) = \min\{\bar{t}, R_m^W(\bar{t}^*)\}$$

The status-quo joint payoff is therefore

$$aW(t^{SQ}(\bar{t}, \bar{t}^*), \bar{t}^*) + \Pi(t^{SQ}(\bar{t}, \bar{t}^*), \bar{t}^*) \equiv aW^{SQ}(\bar{t}, \bar{t}^*) + \Pi^{SQ}(\bar{t}, \bar{t}^*)$$

where $\Pi = p(\cdot)x$. We can again focus on the Cone, therefore the joint-surplus maximizing tariff is the binding level $\bar{t}$, hence the joint surplus over the status quo is

$$JS(\bar{t}, \bar{t}^*) = (aW(\bar{t}, \bar{t}^*) + \Pi(\bar{t}, \bar{t}^*)) - (aW^{SQ}(\bar{t}, \bar{t}^*) + \Pi^{SQ}(\bar{t}, \bar{t}^*))$$

We can now impose the condition that the government obtains a share σ of the joint surplus over the status quo:

$$aW(\bar{t},\bar{t}^*) + C = aW^{SQ}(\bar{t},\bar{t}^*) + \sigma \cdot JS(\bar{t},\bar{t}^*)$$

which yields

$$C(\bar{t},\bar{t}^*;\sigma) = \sigma(\Pi(\bar{t},\bar{t}^*) - \Pi^{SQ}(\bar{t},\bar{t}^*)) + a(1-\sigma)(W^{SQ}(\bar{t},\bar{t}^*) - W(\bar{t},\bar{t}^*))$$

Similarly, we can derive foreign contributions:

$$C^*(\bar{t},\bar{t}^*;\sigma) = \sigma(\Pi^*(\bar{t},\bar{t}^*) - \Pi^{*SQ}(\bar{t},\bar{t}^*)) + a(1-\sigma)(W^{*SQ}(\bar{t},\bar{t}^*) - W^*(\bar{t},\bar{t}^*))$$

Next note that σ affects the ex-ante objective only through contributions. The optimal ceilings solve

$$\begin{aligned}\max_{\bar{t},\bar{t}^*} \psi(\bar{t},\bar{t}^*;\sigma) &= a[W(\bar{t},\bar{t}^*) + W^*(\bar{t},\bar{t}^*)] + \delta[\Pi(\bar{t},\bar{t}^*) + \Pi^*(\bar{t},\bar{t}^*)] \\ &\quad +(1-\delta)[C(\bar{t},\bar{t}^*;\sigma) + C^*(\bar{t},\bar{t}^*;\sigma)]\end{aligned}$$

We are now ready to revisit the results of the previous section. First we note that the optimal ceilings must again be on the R_x curve. The argument we made in the $\sigma = 0$ case still holds. The intuition is similar: the key point is that, if we move up along a 45 degree line inside the Romboid, the allocation does not change (hence W and Π do not change) but contributions increase. This is because (it can be shown that) both surplus terms $(\Pi(\bar{t},\bar{t}^*) - \Pi^{SQ}(\bar{t},\bar{t}^*))$ and $(W(\bar{t},\bar{t}^*) - W^{SQ}(\bar{t},\bar{t}^*))$ are increasing functions of $\left(\bar{t} - R_m^W(\bar{t}^*)\right)$. The same can be said for the foreign side as well, so also C^* increases.

Thus, the result that the optimal ceilings are weakly lower than the respective noncooperative levels holds for any σ. Moreover, one can show that also the other statements of Proposition 4 hold for any σ. The next question is, how does a change in σ affect the optimal agreement? The following proposition answers this question:

Proposition 5. *For $\delta < 1$, an increase in σ (weakly) increases the optimal ceilings $\bar{t}$ and $\bar{t}^*$.*

Proof: Since σ does not affect the R_x curve and the optimal point is the one that maximizes ψ along R_x, all we need to check is the sign of the cross derivative

$$\begin{aligned}&\frac{\partial}{\partial\sigma}\left(\frac{d}{d\bar{t}}\psi(\bar{t},R_x(\bar{t});\sigma)\right) \\ =\ &\frac{d}{d\bar{t}}\left(JS(\bar{t},R_x(\bar{t})) + JS^*(\bar{t},R_x(\bar{t}))\right)\end{aligned}$$

It can be shown that JS^* is constant along R_x, because $\bar{t}^* - R_x^W(\bar{t})$ is constant, as we are moving parallel to the R_x^W curve. On the other hand, JS increases as we move up R_x, because we move closer to R_m. More precisely, we can decompose a movement along R_x into (i) a move along a line of slope 3 (the same slope as R_m), which does not affect JS, and (ii) a horizontal move, which increases $\bar{t} - R_m^W(\bar{t}^*)$ and therefore increases JS. We can conclude that

$\frac{\partial}{\partial \sigma}\left(\frac{d}{d\bar{t}}\psi(\bar{t}, R_x(\bar{t}); \sigma)\right) \geq 0$. This means that the objective function is (weakly) supermodular in $\bar{t}$ and σ, which implies that the optimal ceilings $\bar{t}$ and $\bar{t}^*$ weakly increase with σ.[9] **QED**

The intuition for this result is simple. An increase in σ implies that governments are able to extract more rents from the respective lobbies in the ex-post stage of the game, and hence have less to gain from trade liberalization. This result is broadly consistent with the results of our earlier paper, Maggi and Rodríguez-Clare (1998), where we showed that a small-country government prefers a commitment to free trade to no commitment at all if its bargaining power is lower than a critical level.

5. Alternative lobbying structures

The basic model assumes that both import-competing interests and export interests are politically organized. In this section we discuss how results change if only import-competing producers or only exporters are organized. To simplify the exposition, we go back to the assumption that governments have zero bargaining power.

We start with the case in which only import-competing producers are organized.

Let us first consider the noncooperative equilibrium. The main changes in the analysis in this case stem from the fact that the R_x curve coincides with the R_x^W curve. There are three differences relative to our basic model: first, the (non-cooperative) equilibrium export subsidy is always negative ($t^* < 0$), whereas before this was true only for a sufficiently high; second, the equilibrium always entails less trade than under free trade, something that in the basic model was true only for $a > 1$; and third, there is positive trade in the noncooperative equilibrium only if a is sufficiently high (in particular, as long as $a > x/\Delta x$), otherwise the equilibrium is autarky. All of these changes are a consequence of the fact that there are no political pressures by exporters, which in the basic model pushes in the direction of export subsidies and more trade in the non-cooperative equilibrium.

Next we turn to trade agreements. Let us focus on the case in which $\delta < 1$.[10] The optimal agreement is still a point on the R_x curve: if this were not the case, then the tariff and subsidy ceilings could be increased along a 45 degree line, leaving everything unchanged except that contributions to the Home government would increase. With $\delta < 1$, this would increase ex-ante joint surplus of the two governments and the import-competing lobby at Home. Moreover, just as in the basic model, the optimal agreement lies on the R_x line between points Q and N, where point Q is the intersection of the R_x line and the POL.

The interesting change in results is that the extent of trade liberalization may no longer be decreasing in δ. Because of the asymmetry in lobbying, more effective ex-ante lobbying may lead to less trade liberalization. The following proposition illustrates this possibility.

[9] Note that if the optimal point is on R_x but outside of the romboid, then there are no contributions in Home. This implies that $JS = 0$, and hence $\frac{\partial}{\partial \sigma}\left(\frac{d}{d\bar{t}}\psi(\bar{t}, R_x(\bar{t}); \sigma)\right) = 0$, so the optimal agreement is not affected by σ.

[10] If $\delta \geq 1$ one can focus on complete agreements, just as in our basic model. The best complete agreement would maximize $\psi = a(W + W^*) + \delta px$. This yields the condition $t - t^* = \delta x/a$. As in the basic model, there is indeterminacy of trade tax levels, but now there is *less* trade under the optimal complete agreement than under free trade. This is because in this case there are no political pressures from exporters pushing for more trade.

Proposition 6. *Suppose that only import-competing producers are organized. If $\delta < 1$ then:*
(i) The optimal ceilings $(\bar{t}, \bar{t}^*)$ are unique and satisfy $\bar{t} \leq t^N$, $\bar{t}^* \leq t^{*N}$.
(ii) If δ is close to one, the optimal point is close to the intersection between the POL and the R_x line (point Q).
(iii) If δ is decreased (locally) below one, the optimal point moves Southwest along R_x if $a > 5x/4\Delta x$, and it moves Northeast along R_x if $a < 5x/4\Delta x$.

Proof: See Appendix.

The new result here is that, for a sufficiently large, trade liberalization is decreasing in the strength of ex-ante lobbying. The reason for this change in result relative to the previous section is the following. Import-competing producers care both about increasing protection and decreasing contributions. Decreasing contributions requires pushing the agreement away from N, but increasing protection requires pushing the agreement close to the noncooperative point N. The first effect is the same as in our basic model (where export interests were organized), but the second effect is new and is due to the asymmetry in lobbying. Thus there are two opposite effects as δ increases, and depending on parameters one or the other effect will prevail.

The reason why the first effect is weaker when a is high is the following. It turns out that, in the noncooperative equilibrium, total contributions are decreasing in a, namely they are equal to $x^2/6a$ (this counterintuitive result is due to the fact that equilibrium protection changes enough with a that the net effect of increasing a is to lower contributions). For this reason, increasing a reduces the importance of contributions in the objective of import-competing producers, thus leading them to focus more on increasing protection.[11]

Finally we turn to the case in which only exporters are organized. In this case, the key change in the analysis is that the R_m curve coincides with the R_m^W curve.[12] Following the same line of argument as above, one can show that the optimal agreement is a point on the R_x curve (imagine we were below, then increasing the celings along a 45 degree line would leave everything unchanged, except that contributions to Foreign would increase), but this time the optimum is always point Q, that is the intersection between R_x and the POL line, for any δ and a. The reason is that, since there are no contributions from import-competing producers, and exporters' contributions are constant along R_x (see section 3.4), the only relevant consideration when choosing a point on R_x is maximizing political efficiency, which implies that the optimum must be on the POL line.

Formally, since contributions are constant along R_x, the agreement is given by the pair (t, t^*) that maximizes

$$\psi(t) = a(W(t, R_x(t)) + W^*(t, R_x(t))) + \delta p^*(t, R_x(t))x^*$$

But this yields the POL condition, which in this case is $t - t^* = -\delta x^*/a$. Interestingly, therefore, when lobbying pressures come only from the exporters' side, our model delivers exactly the same prediction as the "standard" model (with no lobbying from import-competing interests and with

[11] The reason we can only offer a local comparative-statics result is that for $\delta < 5/8$ the objective function $\psi(t)$ is not concave, which makes it hard to track how the global optimum changes with δ.

[12] The Nash equilibrium is again given by the intersection of curves R_m and R_x, which now entails less trade than under free trade if and only if $a > 2x^*/\Delta x$.

exact tariff restrictions) in terms of net protection ($t - t^* = -\delta x^*/a$), with the difference that it pins down the levels of the import tariff and the export subsidy.

6. Conclusion

Although there has been tremendous progress over the last decades in understanding the role of trade agreements in reducing net trade protection, surprisingly little has been achieved in explaining the changes in the levels of tariffs and subsidies that these agreements bring about. In other words, the standard theory of trade agreements (i.e., Grossman and Helpman, 1995, and Bagwell and Staiger, 1999) is a theory about the determination of net trade protection rather than actual tariffs and export subsidies. In this paper we have shown how the standard theory can be amended to deliver sharper and more realistic predictions about the outcome of trade agreements.

Our point of departure is that we disentangle two processes that in the standard theory are collapsed into one: first, the negotiation of the trade agreement, and second, the ex-post determination of trade policies subject to the constraints imposed by the agreement. This distinction is irrelevant if ex-ante lobbying is as strong as ex-post lobbying. But if ex-ante lobbying is weaker than ex-post lobbying, then this distinction matters greatly, because governments will prefer agreements that leave some discretion in order to generate political contributions after the agreement has been signed. As we have shown, incomplete agreements that impose only tariff and subsidy ceilings will be preferred to complete agreements. Crucially, such incomplete agreements do not suffer from the indeterminacy associated with complete agreements, since contributions vary with the levels of tariffs and subsidies, not only with *net* trade protection.

We have tried to capture these considerations in a very simple model. In spite of its simplicity, the model delivers interesting insights about the determinants of the agreed-upon import tariffs and export subsidies. We found that the optimal agreement weakly reduces both import tariffs and export subsidies relative to their noncooperative levels. Under some conditions this reduction is strict, but there is also a parameter region for which there is no trade liberalization at all. Conditional on the parameter region for which the agreement implements tariff and subsidy cuts, the model offers some interesting comparative-statics results. Perhaps the most noteworthy results concern the role of ex-ante lobbying. If both import-competing interests and export interests are organized, we find that trade liberalization is deeper when ex-ante lobbying is stronger relative to ex-post lobbying. On the other hand, if only import-competing interests are organized, stronger ex-ante lobbying may lead to more or less trade liberalization, depending on the importance of contributions in the governments' objectives.

7. Appendix

Proof of Proposition 4

We first argue that the optimum is on the boundary of the Cone. Consider a point in the interior of the Cone. We can dominate this point by moving up a 45^0 line. This leaves the allocation unchanged while total contributions $C + C^*$ increase (at least eventually). To see this, focus on home contributions first. If the agreement (i.e., the point $(\bar{t}, \bar{t}^*)$) is below R_m^W then $C = 0$. If the agreement is above R_m^W then C increases as we move up a 45 degree line, because C is an increasing function of $\left(t - R_m^W(t^*)\right)$ and $R_m^W(t^*)$ has slope 2/3, so the difference $\left(t - R_m^W(t^*)\right)$ increases as we move up a 45 degree line. Now focus on foreign contributions. By a similar argument, if the agreement is below R_x^W then $C^* = 0$, while if it is above R_x^W then C^* increases as we move up a 45 degree line. By graphical inspection, then, it follows that as the agreement moves up a 45 degree line inside the Cone, total contributions $C + C^*$ increase weakly, and must increase strictly before we hit the boundary of the Cone. This establishes that the optimum is on the boundary of the Cone.

Now suppose by contradiction that the optimum is not on R_x. Then it must be on the R_m line. But then we can improve the objective by moving up along the R_m curve: this increases contributions, since C is constant (recall that along $R_m(t^*)$ contributions to the Home government are $x^2/6a$) and C^* increases, and also improves the allocation, since we get closer to the POL. To see this more formally, leave aside contributions in the objective function and just focus on the objective function with $\delta = 1$. (We can do this because contributions increase as we move up along the R_m curve). We know that this special objective function is constant as we move along a 45 degree line, but increases as we move vertically towards the POL. Since a movement up along R_m can be decomposed into a movement up along a 45 degree line and a vertical movement towards the R_m curve, then this movement increases the special objective function. Thus we can conclude that the optimum is on R_x.

Next we look for the optimal point along R_x. Let point Q be the intersection of the POL with R_x, and point V be the intersection of R_x and R_m^W; this is the upper left vertice of the Romboid. Along R_x and to the left of V the objective function is:

$$\begin{aligned}\psi(t) &= U(t) \equiv a(W(t, R_x(t)) + W^*(t, R_x(t))) \\ &\quad + \delta(p(t, R_x(t))x + p^*(t, R_x(t))x^*) + (1-\delta)\left(x^*\right)^2/6a\end{aligned}$$

while to the right of V we have:

$$\psi(t) = U(t) + (1-\delta)C(t)$$

where

$$C(t) \equiv (3a/8)\left[t - R_m^W(R_x(t))\right]^2$$

Differentiation and simplification reveals that:

$$U'(t) = (a/18)(-2\Delta x - 4t + 4x^*/a) - (\delta/3)\Delta x$$

Hence, $U''(t) < 0$, and it is easy to check that $U(t)$ is maximized at t_Q, the value of the import tariff at point Q. This can be checked by (1) solving for t_Q as the intersection of the POL and the R_x line, which yields:

$$t_Q = x^*/a - (1 + 3\delta/a)\Delta x/2$$

and then (2) plugging into $U'(t)$ and (3) checking that $U'(t_Q) = 0$.

We now analyze the behaviour of the objective function inside the Romboid, that is $\psi(t) = U(t) + (1 - \delta)C(t)$. Noting that

$$\begin{aligned} C'(t) &= (3a/8)2\left[t - R_m^W(R_x(t))\right]\left(1 - (dR_m^W/dt^*)(dR_x/dt)\right) \\ &= (2a/3)\left[t - R_m^W(R_x(t))\right] \end{aligned}$$

then it follows that if $\delta < 1$ then

$$\psi'(t_Q) = U'(t_Q) + (1 - \delta)C'(t_Q) = 0 + C'(t_Q) > 0$$

and hence the agreement must be strictly to the right of Q. It also follows from the previous steps that if δ is close to one then the optimum is close to Q.

We now argue that the optimal t is weakly decreasing in δ. First note that $\psi(t)$ is differentiable everywhere (including at point V). Next note that

$$U_{t\delta} = -\Delta x/3 < 0$$

and

$$\psi_{t\delta} = -\Delta x/3 - (2a/3)\left[t - R_m^W(R_x(t))\right] < 0$$

This implies that both U and ψ are submodular in t and δ, which in turn implies that the optimal t is weakly decreasing in δ.

Since the optimal t is weakly decreasing in δ, it follows that the optimal t is lower than t^N iff $\delta > \hat{\delta}$, where $\hat{\delta}$ is some critical level in $[0, 1]$. We can say something more about $\hat{\delta}$. Since we have established above that the optimal point approaches Q as δ approaches one, it follows that $\hat{\delta} \in [0, 1)$.

Next we show that $\hat{\delta} > 0$ if $a \leq x^*/\Delta x$. What we need to show is that, if $a \leq x^*/\Delta x$, then for $\delta = 0$ the optimal tariff is t^N. A sufficient condition for this is that $U'(t_V)|_{\delta=0} \geq 0$ (since U is concave and we know that if $\delta = 0$ then ψ is convex for $t > t_V$, which implies that ψ is increasing for all t). It is a matter of simple algebra to show that this condition is satisfied if $a \leq x^*/\Delta x$. **QED**

Proof of Proposition 6

We have already argued that the optimal ceilings are unique and lie on the R_x^W curve. We need to prove points (i) and (ii). To find the optimal point along the R_x^W curve, note that the ex-ante joint surplus for $t < t_V$ is

$$\psi(t) = U(t) \equiv a(W(t, R_x^W(t)) + W^*(t, R_x^W(t))) + \delta(p(t, R_x^W(t))x$$

while for $t > t_V$ the joint surplus is given by:

$$\psi(t) = U(t) + (1 - \delta)C(t)$$

where $C(t) = (3a/8)\left[t - R_m^W(R_x^W(t))\right]^2$ is the contribution paid by the lobby. Simple derivation reveals that

$$U'(t) = -(a/9)(\Delta x + 2t) + \delta x/3$$

For future reference note that

$$C'(t) = (4a/27)(4t - \Delta x)$$

Also note that

$$U''(t) = -2a/9 < 0$$

Let t^{opt} denote the optimal tariff. When δ is close to one, clearly t^{opt} is close to the tariff that maximizes $U(t)|_{\delta=1}$, i.e. the one that solves

$$-(a/9)(\Delta x + 2t) + x/3 = 0$$

This yields

$$t = [(3x/a) - \Delta x]/2$$

It is easy to check that this is the same as the value of the tariff at point Q, that is the intersection of the POL (given by $t - t^* = \delta x/a$) and the R_x^W curve. From now on, to avoid confusion we emphasize that point Q depends on δ by writing Q(δ).

Let us prove point (iii). Our method is the following: we start from $\delta = 1$, in which case we know that the optimum is point Q(1), and we check how the optimum moves as we decrease δ. We first need to check whether point Q(1) lies to left or to the right of point V. Note that

$$\begin{aligned} t_{Q(1)} &= [(3x/a) - \Delta x]/2 \\ t_V &= \Delta x/4 \end{aligned}$$

Thus $t_{Q(1)} < t_V$ iff $a > 2x/\Delta x$. We consider the two cases in turn:

Case (a): $a > 2x/\Delta x$. To see how t^{opt} moves as δ falls below one, let us check the sign of $U_{\delta t}$:

$$U_{\delta t} = x/3 > 0$$

Since $U''(t) < 0$, this implies that t^{opt} is increasing in δ in a left neighborhood of $\delta = 1$.

Case (b): $a < 2x/\Delta x$. Now the relevant cross-derivative is

$$\psi_{\delta t} = U_{\delta t} - C_t$$

Evaluating this at $t_{Q(1)}$, we find that $\psi_{\delta t} > 0$ iff

$$a > 5x/4\Delta x$$

Since for $\delta > 5/8$ we have that $\psi''(t) < 0$ then this implies that t^{opt} is increasing in δ in a left neighborhood of $\delta = 1$ iff $a > 5x/4\Delta x$. Noting that $2x/\Delta x > 5x/4\Delta x$ and putting the previous two results together, we can conclude that t^{opt} is increasing in δ in a left neighborhood of $\delta = 1$ iff $a > 5x/4\Delta x$. **QED**

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Figure 1