Transaction Costs, Asymmetric Countries and Flexible Trade Agreements*

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Abstract

We study optimal design of trade agreements when the implementation of a state-contingent agreement involves the cost of verifying the prevailing state of the world. Under costly state-verification the optimal trade agreement has the form of a tariff cap with an escape clause. We also study the role of country asymmetry and show that under an optimal agreement larger countries are more likely to be bound by the tariff cap and to use the escape clause. Smaller countries, on the other hand, tend to have larger tariff overhang. These predictions are consistent with our empirical observation that the WTO members frequently apply tariffs that are below their bindings, and that the likelihood of applying tariff at the binding is positively correlated with the country size.

1 Introduction

Although trade agreements have been successful at reducing the level of trade barriers, they also contain a number of features that provide countries a degree of

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flexibility in the setting of their tariff rates. One type of flexibility is due to the fact that countries make commitments in the form of tariff bindings, which allows countries to unilaterally adjust tariffs as long as they do not exceed the tariff binding. A second type of flexibility is provided by safeguard mechanisms, which allow countries to raise tariffs above binding levels in the event that certain conditions are met. Safeguard measures require countries to follow specified procedures in approving protection, and these procedures are subject to challenge through the dispute settlement process.

A demand for flexibility may arise in situations where governments experience shocks to their preferences that result in a greater demand for protection, so that there will be states of the world where an agreement specifying a fixed tariff rate for each country will be inefficient. If these shocks are fully observable and complete state contingent contracts can be written, then flexibility can be explicitly written into the agreement. However, the existence of private information about the size of these political shocks may make it costly to provide tariff adjustments.

This paper contributes to the existing literature on flexible trade agreements in two ways. First, we study the role of country asymmetry in the optimal design of a flexible agreement. In particular, we recognize that the effectiveness of the flexibility mechanisms depends on the size of the countries involved. When countries are small, giving a country the power to adjust its tariff in response to political shocks has little effect on exporting countries, because the small country lacks significant market power. On the other hand, a large country will impose a significant externality on trading partners when it adjusts its tariff. We show that as a result of this effect, an efficient agreement with tariff bindings will have the feature that large countries are more likely to be at the binding than small countries.

Transaction cost of using different flexibility mechanisms is another crucial determinant of the optimal design of trade agreements in the presence of uncertainty. We contemplate that the flexibility provided by tariff bindings involves a lower transaction cost compared to the safeguard mechanism, as the former mechanism allows unilateral decisions by the importing country to adjust tariffs to a certain degree, while the latter mechanism is implemented through a costly and time-consuming process of ‘state verification’ and settlement negotiations among the interested parties. On the other hand, the obvious advantage of a safeguard mechanism is its emphasis on verifying the state of the world, which allows the parties to set jointly
optimal tariffs. In this paper we show that, if the transaction cost of adopting safeguard measures is sufficiently low, a hybrid flexibility mechanism that includes both a tariff cap and a safeguard provision outperforms either of these mechanisms when employed exclusively.

The interaction of the two central features of our model, i.e., transaction costs and country asymmetry, provides more insight about the optimal design of a flexible trade agreement. Verifying the state of the world in a country that claims to be in need of higher import protection is usually done through a process that starts with an investigation by the importing country to determine injury to domestic producers due to surge in imports, which may be followed by a dispute settlement procedure in case the importing country’s findings are challenged by the exporting countries. The cost of undertaking these activities seem to be generally independent of the size of the industries and countries involved.\(^1\) Therefore, given that the social costs and benefits of tariffs are functions of the country size and the volume of trade, an increase in the size of the importing country increases the advantage of the safeguard mechanism over a tariff cap. We verify that in a hybrid flexibility mechanism, the optimal tariff cap is a decreasing function of the importing country’s size. Therefore, we predict that the safeguard provision is a flexibility mechanism that is mostly used by larger countries, while smaller countries’s are given flexibility through a higher tariff binding.\(^2\)

The effect of transaction costs on the optimal design of trade agreement has been also studied by Horn, Maggi, and Staiger (2010), and Maggi and Staiger (2008). They show that when writing a contract is costly, it is optimal to craft an incomplete trade agreement in order to save on the ex ante contracting costs. We, however, emphasize the ex post costs of implementing the agreement, which includes the costs of verifying the contingencies that are predicted in the agreement. Due to ex

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\(^1\)We recognize that these costs may depend on the type of the industry under consideration, but we assume that given an industry type, the size of the industry is not a major determinant of the transaction cost of adopting a safeguard measure.

\(^2\)Our approach is similar to that in models with costly state, where an agent’s private information can be observed by the uninformed party by incurring a monitoring cost. The optimal contracts in this literature typically involve two regions: a non-monitoring region in which agents pool and all take the same action and a monitoring region in which the true type is revealed and the efficient action for that type is taken. The seminal paper is Townsend (1979), who used this approach to derive the optimality of debt contracts. The non-monitoring region corresponds to the region where the country’s tariff is determined by the binding. However, there may not be complete pooling in this region because countries may choose to impose tariffs below the binding.
post cost of implementing a contract, it is therefore optimal to write an incomplete contract that gives discretion to the parties in many contingencies. Therefore, our paper provides a different rationale for writing an incomplete trade agreement (such as tariff bindings) on the basis of the cost of implementing, rather than writing, the agreement.

There is a growing body of economic literature on both tariff bindings (e.g., Bagwell and Staiger 2005, Bagwell 2009, and Amador and Bagwell 2010) and safeguards (e.g., Beshkar 2010, Beshkar (forthcoming), and Maggi and Staiger 2009) [add a summary of these papers here]. However, none of these papers study the coexistence of these distinct flexibility mechanisms in the existing trade agreements. Our approach allows us to study the optimal combination of these mechanisms in a trade agreement, which generates novel predictions regarding the optimality of ‘asymmetric agreements’, in which larger countries face more stringent bindings and use the safeguard provision more frequently.

In the next section we provide some empirical evidence about tariff overhang for WTO members. Section 3 introduces the basic setting. In Section 4, we study optimal tariff cap without a safeguard provision in an asymmetric-country setting. We then extend this model in Section 5 by introducing a safeguard clause and its associated transaction costs.

2 Country Size and Tariff Overhang: Empirical Evidence

Table 1 reports summary statistics for tariff overhang for 71 members of the World Trade Organization for 2007, where tariff overhang is defined to exist whenever the MFN applied rate is less than the tariff binding. The data cover between 5100-5200 tariff lines per member, yielding a total of more than 366,000 sectors.3 The data indicate that the WTO agreements provided substantial flexibility for the countries in their setting of tariff rates, since the MFN applied rates are below the

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3The number of sectors differs by countries due to differences in the system of classification chosen across countries. It should be noted that since the European Union is counted as a single unit, the median member in terms of per capita income is Columbia.


Table 1:
Tariff Lines by Overhang Type (# of observations =326,803):

<table>
<thead>
<tr>
<th>Bound Tariff at Binding</th>
<th>Share of Total Tariff Lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bound Tariff &gt; Applied Tariff</td>
<td>0.638</td>
</tr>
<tr>
<td>Bound Tariff &lt; Applied Tariff</td>
<td>0.024</td>
</tr>
<tr>
<td>Unbound Tariff</td>
<td>0.152</td>
</tr>
</tbody>
</table>

Tariff Overhang for Bound Tariff Lines:

<table>
<thead>
<tr>
<th>Tariff Overhang (Binding - Applied)</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.87</td>
<td>29.30</td>
<td></td>
</tr>
<tr>
<td>Overhang ratio (Binding- Applied)/Binding</td>
<td>0.538</td>
<td>0.492</td>
</tr>
</tbody>
</table>

bindings for almost 2/3 of the tariff lines. Furthermore, the amount of flexibility available is substantial both in terms of the absolute overhang (binding - applied rate) and in percentage overhang ((binding-applied)/binding). It should be noted that even though the overall level of flexibility is high, the overhang for particular countries may be quite low. For example, 94% of tariff lines in the US are at the tariff binding. This raises the question of what factors determine the degree of flexibility provided in a particular tariff line.

Table 2 reports the results of a Probit regression where the dependent variable is a dummy variable that is equal to 1 if the tariff is at its binding level for the commodity. The explanatory variables are the level of per capita GDP and the level of GDP. It has been noted that high income countries are more likely to have tariffs that are at their binding, and the regression results are consistent with observation. The interesting feature of the reported regression results is that the effect of the scale of the economy, after controlling for per capital GDP, also makes it more likely that the country is at its binding. Similar conclusions regarding the effect of country size are obtained in a regression of the absolute tariff overhang and the percentage of tariff overhang. The model that we present in the next section provides an explanation of why large countries would be more likely to be at their binding in an efficient trade agreement with political pressure.
Table 2: Probit regression: the likelihood of a tariff line being at its binding.

| Variable        | Coefficient | Std. Err. | t     | P > |t| |
|-----------------|-------------|-----------|-------|-----|---|
| GDP             | 5.18e-07    | 4.06e-09  | 127.73| 0.000|
| (GDP)^2         | -2.32e-14   | 2.58e-16  | -90.11| 0.000|
| cGDP            | .0125175    | .0004009  | 31.23 | 0.000|
| (cGDP)^2        | -.0000223   | 5.15e-06  | -4.33 | 0.000|
| pseudo R-square | 0.1771      |           |       |      |   |

3 The Basic Setting

We examine a two country, three good trade model in which countries are asymmetric in size.\(^4\) The home country is assumed to have a measure \(N\) of identical households, with a home country household having a utility function \(U = \sum_{i=1,2} d_i(1 - 0.5d_i) + d_0\), where \(d_i\) denotes consumption of good \(i\). Households in the home country have an endowment of labor that can be allocated to production of the three goods. Letting \(l_i\) denote the quantity of labor per household devoted to good \(i\) and \(x_i\) the output per household, the home country production functions are assumed to have the form \(x_0 = l_0\) and \(x_i = (2b_i l_i)^5\) for \(i = 1, 2\). Assuming perfect competition in production and choosing good 0 as numeraire, these assumptions about production and technology yield per household demands of \(1 - p_i\) and supplies of \(b_i p_i\) for goods \(i = 1, 2\). Autarky prices in the home country will be \(p_i^A = 1/(1 + b_i).^5\).

The foreign country has a measure \(N^*\) of households, with households preferences identical to those of home households. Foreign country production functions are given by \(x_0^* = l_0^*\) for the numeraire good and \(x_i^* = (2b_i^* l_i)^5\) for \(i = 1, 2\). Autarky prices in the foreign country will be \(p_i^{A*} = 1/(1 + b_i^*)\). We assume that \(b_1 = b_2 = 1\) and \(b_2 = b_1^* = \beta > 1\), so that the home country has comparative advantage in good 2 and the foreign country a symmetric advantage in good 1. Letting \(t\) (\(t^*\)) be the specific tariff imposed by the home (foreign) country on imports of good 1 (2), we have \(p_1 = p_1^* + t\) and \(p_2 = p_2 + t^*\) with trade. In light of the separability and symmetry of markets, we can focus our analysis on the market for the home importable. The characterization of the market for the foreign importable follows

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\(^4\)Our model is a variant of the asymmetric country in Bond and Park (2002).

\(^5\)We assume that the endowment of home labor per household is sufficiently large that some of good 0 gets produced in equilibrium.
immediately. The home excess demand function for good 1 is \( m = N(1 - 2p) \), and foreign excess demand is \( m^* = N^*(1 - (1 + \beta)p^*_t) \). Since equilibrium prices are homogeneous of degree 0 in \( N \) and \( N^* \), we can normalize country size by choosing \( N = \lambda \in (0, 1) \) and \( N^* = 1 - \lambda \). The market clearing price of good 1 in the respective countries will be market price of 

\[
p^* = \frac{1 - t(1 + \beta)}{1 + \lambda + \beta(1 - \lambda)} \quad p = \frac{1 + t(1 + \beta)(1 - \lambda)}{1 + \lambda + \beta(1 - \lambda)}
\]

(1)

The relative size of the countries determines the magnitude of the terms of trade externality resulting from the home country tariff, with \( dp^*/dt \to 0 \) as \( \lambda \to 0 \) and \( dp^*/dt \to -1 \) as \( \lambda \to 1 \). The prohibitive tariff will be \( t^{pro} = (\beta - 1)/(2(\beta + 1)) \).

We assume that the government’s preference over tariffs can be described by a weighted social welfare function, where the government puts a weight of \( \theta \geq 1 \) on the welfare of producers in the import-competing sector and a weight of 1 on the welfare of all other agents. Home country consumer surplus is given by \( C(t, \lambda) = \lambda(1 - p(t, \lambda)^2)/2 \), producer surplus by \( \pi(t, \lambda) = \lambda p(t, \lambda)^2 \), and tariff revenue by \( tm(t, \lambda) \). For the foreign country, consumer surplus is \( C^*(t, \lambda) = (1 - \lambda)(1 - p^*(t, \lambda)^2)/2 \) and producer surplus is \( \pi^*(t) = (1 - \lambda)\beta p^*(t)^2 \). Letting \( V(V^*) \) denote the home country welfare attributed to the importable (exportable) sector, the respective welfare functions will be

\[
V(t, \theta) = C(t, \lambda) + \theta \pi(t, \lambda) + tm(t, \lambda). \quad (2)
\]

\[
V^*(t) = C^*(t, \lambda) + \pi^*(t, \lambda). \quad (3)
\]

The foreign country welfare function is decreasing and in \( t \) because of the adverse effect of the home country tariff on good 1 on the foreign country’s terms of trade, which is proportional to the level of foreign exports. Foreign welfare is convex in \( t \), because the magnitude of the terms of trade effect declines as the volume of trade declines.

In the absence of political economy considerations (i.e. \( \theta = 1 \)), home country welfare will be strictly concave in \( t \), reflecting the terms of trade and trade volume effects of an increase in the home country tariff. Increases in \( t \) improve the home country terms of trade, but the marginal benefits decline with \( t \) due to declining trade volume and increasing trade distortions. The presence of political economy effects
introduces a convex element into this problem, since profits of import-competing producers are increasing in and convex in $t$. However, it can be shown that the home country welfare function is strictly concave in $t$ over the relevant range at which trade occurs. Therefore, there will be a unique optimal tariff that maximizes $V^M(t)$, which is given by

$$t^N(\theta, \lambda) = \frac{(\theta - 1)(1 + \beta) + 2\lambda(\beta - 1)}{(1 + \beta)(3 + (1 - \lambda)(3\beta - \theta(1 + \beta))) + 5\lambda}. \quad (4)$$

As a result of the separability assumption, this tariff is a dominant strategy for the home country and will be the Nash equilibrium tariff. For $\theta = 1$, the optimal tariff is positive for $\lambda > 0$ and increasing in $\lambda$, reflecting the use of the importing country’s market power to improve its terms of trade. For $\theta > 1$, increases in the tariff also provide the benefit of providing a transfer to import-competing producers who receive a greater weight in national welfare. As a result, the optimal tariff is increasing in $\theta$. We let $\theta_{max} \equiv (3\beta - 1)/(1 + \beta)$ denote the value of the political shock at which the home country’s optimal tariff eliminates trade, $t^N(\theta_{max}, \lambda) = t^{pro}$.

World welfare is the sum of home and foreign country welfare, $W(t, \theta) = V(t, \theta) + V^*(t)$. For $\theta = 1$, world welfare is strictly in concave in $t$ and is maximized at free trade. The political economy component introduces an additional convex element into world welfare for $\theta > 1$, but it can be shown that world welfare will be strictly concave in $t$ for $\theta \in [1, \theta_{max}]$. There will be a unique tariff that maximizes world welfare

$$t^E(\theta, \lambda) = \frac{\theta - 1}{3 + (1 - \lambda)(3\beta - \theta(1 + \beta))}. \quad (5)$$

The efficient tariff will be positive for $\theta > 1$, since world welfare incorporates the importing country’s preference to protect its producers. For $\theta_{max}$, the weight on producer interests is sufficiently high that the efficient tariff eliminates trade. Note also that $t^N(\theta, \lambda) - t^E(\theta, \lambda) \geq 0$ for $\theta \in [1, \theta_{max}]$ The Nash tariffs exceed the tariffs that maximize world welfare when the home country has market power, because the home country fails to internalize the terms of trade externality it imposes on the foreign country. The Nash and efficient tariffs are only equal in the absence of market power effects, which occurs when the country is infinitesimally small or trade is eliminated (i.e. $t^N(\theta_{max}, \lambda) = t^E(\theta_{max}, \lambda)$ and $t^N(\theta, 0) = t^E(\theta, 0)$).

The analysis for good 2 can be derived in a similar fashion, with the symmetry
insuring that the efficient tariff for good 2 will be \( t^E(\theta, 1 - \lambda) \) and the Nash equilibrium tariff will be \( t^N(\theta, 1 - \lambda) \). As a result, the non-cooperative equilibrium is a prisoner’s dilemma for a given \( \theta \) and world welfare can be increase.

We will analyze the case in which the political weights are stochastic, with pdf \( f(\theta) \) that has compact support \([1, \bar{\theta}]\). If the magnitude of the shock is public information, world welfare can be improved by a state-contingent trade agreement that specifies tariffs of \( t^E(\theta, \lambda) \). We will focus on the case in which the level of the political shocks is private information.

4 Optimal Binding with no Escape Clause

We assume that a trade agreement takes the form of a tariff binding, denoted \( t^B \), such that the importing country is allowed to choose any tariff \( t \leq t^B \). The tariff choice of the importing country when the political shock is \( \theta \) will be \( t(\theta) = \min\{t^N(\theta), t^B\} \).

If \( t^B \leq t^N(1) \), then the country’s tariff is always at the binding level. If \( t^B \in [t^N(1), t^N(\bar{\theta})] \), then the home country will choose \( t^N(\theta) \) for \( \theta \leq \theta^B = t^{N^{-1}}(t^B) \) and \( t^B \) otherwise. In this case, the probability of tariff overhang is \( F(\theta^B) \).

Expected world welfare under a tariff binding agreement is

\[
\max_{t^B} \left[ \int_1^{\theta^B} W(t^N(\theta); \theta)f(\theta)d\theta + \int_{\theta^B}^{\bar{\theta}} W(t^B; \theta)f(\theta)d\theta \right]
\tag{6}
\]

The optimal binding will be the choice of \( t^B \) that maximizes (6) subject to \( \theta^B = \max\{1, t^{N^{-1}}(t^B)\} \).

We first consider the case where \( t^B < t^N(1) \) and \( \theta^B = 1 \). Using the fact that \( W(t, \theta) = W(t, 1) + (\theta - 1)\pi(t) \), we can write the effect of a change in the binding on welfare as \( W_t(t^B, 1) + \pi_t(t^B) \int_1^{\theta^B} (\theta - 1)f(\theta)d\theta \). The first term in the expression is the effect of an increase in the tariff on unweighted world welfare, which must be negative for \( t^B > 0 \). The second term is the expected benefit of the transfer to producers in the import-competing sector resulting from an increase in the tariff. Letting \( R(t, \lambda) = -W_t(t, 1)/\pi_t(t) \), we can write the necessary condition for a corner solution where the tariff always binds as

\[
E(\theta - 1) = R(t, \lambda) = \frac{2t(1 + \lambda + \beta(1 - \lambda))}{1 + t(1 + \beta)(1 - \lambda)}
\tag{7}
\]
where $E(.)$ denotes the expectation operator. The left hand side of this equation is the expected benefit of a dollar transferred to special interests, while the right hand side is the deadweight loss per dollar of income transferred via protection. Since $R$ is increasing in $t$, a binding satisfying (7) will be a local optimum.\footnote{The marginal deadweight loss is increasing in $t$, but the marginal benefit to producers is also increasing in $t$. However, the former effect dominates.}

Figure 1 illustrates the marginal benefit and marginal cost of raising the binding at a corner solution from (7). The intersection of the marginal benefit and marginal cost loci will satisfy the necessary condition if it also satisfies $E(\theta - 1) \leq R(t^N(1), \lambda)$, as illustrated in Figure (1). Substituting from (4), there will exist a corner solution satisfying the necessary conditions if

$$\frac{\lambda}{1 - \lambda} \geq \frac{E(\theta - 1)(1 + \beta)}{2(\beta - 1)}$$

This condition is more likely to be satisfied the larger is the size of the importing country. A larger country has a larger optimal tariff, which means that there is greater cost of allowing the large country the flexibility to set its own tariff. In particular, note that there cannot be a corner solution where the tariff is always at the binding for countries that are sufficiently small if $E(\theta) > 1$.}
We can also use (7) to derive the effects of country size and comparative advantage on the level of the binding at a corner solution. Solving for the effect of a change in country size yields

$$\frac{dt^B}{d\lambda} = -\frac{R_\lambda}{R_t} = \frac{2t(\beta - 1 - 2t(1 + \beta))}{2(\beta(1 - \lambda) + 1 + \lambda)} > 0$$ (9)

This expression must be positive for $t < (\beta - 1)/(2(1 + \beta))$, which must hold for all $t \leq t^N(\lambda, 1)$. An increase in country size raises the marginal deadweight loss and also raises the benefit from protection. The latter effect dominates, resulting in a reduction in the marginal deadweight loss at a given $t$ as country size increases. The effect of an increase in $\beta$ is

$$\frac{dt^B}{d\beta} = -\frac{R_\beta}{R_t} = \frac{2t(1 - \lambda)(1 - 2t\lambda)}{2(\beta(1 - \lambda) + 1 + \lambda)} < 0$$ (10)

This expression is negative for $0 < t < 1/(2\lambda)$, which must hold for all $t \leq t^N(\lambda, 1)$. An increase in comparative advantage raises the marginal deadweight loss per unit of profit, which reduces the optimal binding at a corner solution.

### 4.1 Bindings with Overhang

We next consider the case of an interior solution, where the binding does not hold for all $\theta$. For this case, it is convenient to express the problem as choosing $\theta^B$ to maximize (6), where $t^B = t^N(\theta^B)$. The benefit of raising the threshold for the binding can be written as

$$W_i(t^N(\theta^B), 1)(1 - F(\theta^B)) + \pi_i(t^N(\theta^B)) \int_{\theta}^{\theta}(\theta - 1)f(\theta)d\theta.$$

The first term in this expression is the expected marginal deadweight loss from the binding, and the second term is the expected gain to the transfer to special interests. Defining $\tilde{R}(\theta, \lambda) = R(t^N(\theta, \lambda), \lambda)$, we can rewrite the necessary condition as

$$E[\theta - 1|\theta \geq \theta^B] = \tilde{R}(\theta^B, \lambda) = \frac{2\lambda(\beta - 1) + (\beta + 1)(\theta^B - 1)}{(1 + \lambda)(1 + \beta)}.$$ (11)

where $E[\cdot|\theta \geq \theta^B]$ is the conditional expectation operator. As in the case of a corner solution, the optimal binding is obtained by equating the expected gain from a transfer to import competing producers to the marginal deadweight loss per dollar of profit generated.
Figure 2: An interior solution for the optimal binding with no safeguard clause.

The marginal benefit/marginal cost condition for determining the threshold political shock is illustrated in Figure (2). The $\tilde{R}$ locus is increasing in $\theta$, with $\tilde{R}(\theta_{max}, \lambda) = \theta_{max} - 1$. A higher threshold for the political shock results in a larger optimal tariff and a larger marginal deadweight loss. The slope of this relationship is $1/(1 + \lambda)$, so increases in country size result in an upward rotation of the $\tilde{R}$ locus around the point $(\theta_{max} - 1, \theta_{max})$ in Figure (2). Note however that the expected return to raising the binding is also increasing in the level of the binding for $\theta < \bar{\theta}$, as illustrated by the dashed line in Figure (2), because the expected return is conditional on the political weight exceeding the threshold. In order for the interior solution to be a maximum, we must have $E[\theta 1|\theta \geq \theta_B] < 1/(1 + \lambda)$. In the case of a uniform distribution, where $E[\theta 1|\theta \geq \theta_B] = (\theta_B + \bar{\theta})/2$, the existence of an interior solution requires $\theta < \theta_{max}$.

It is clear from Figure (2) that $\theta_B$ is decreasing in $\lambda$ at an interior solution. For a small country binding will always be at $\bar{\theta}$, since $\tilde{R}(\theta, 0) = \theta - 1$ and $E[\theta 1|\theta \geq \theta_B] > \theta_B$ for $\theta < \bar{\theta}$. As was found in the case of a corner solution, the fact that larger countries have higher optimal tariffs will make it desirable to limit the flexibility of
larger countries to vary tariff rates unilaterally. Thus, we obtain the general result that a large country is more likely to be at its binding than is a smaller country.

A related question is whether a large country will have a higher binding than will a smaller country. Totally differentiating yields $dt^B/d\lambda = t^N_\theta(\theta^B, \lambda)(d\theta^B/d\lambda) + t^N_\lambda(\theta^B, \lambda)$. A larger country has a lower threshold level of the political shock at which the binding holds, as established above, which tends to reduce the bound tariff. However, the larger country has a larger optimal tariff for a given value of the political shock. To compare the magnitude of these effects, we utilize the comparative statics result $d\theta^B/d\lambda = \tilde{R}_\lambda/(\tilde{R}_\theta - E_\theta(\theta|\theta) \geq \theta^B)$. Substituting into this expression using (11) and (4) yields the following condition for an increase in country size to reduce the tariff binding:

$$\frac{1}{1 + \lambda} - E_\theta(\theta|\theta) \geq \theta^B < \frac{t^B_\theta R^\lambda}{t^N_\lambda} = \frac{2(1 + \beta(1 - \lambda) + \lambda}{(1 + \beta)(1 + \theta)(1 + \lambda)}$$

This condition is more likely to be satisfied the greater the effect of the threshold on the expected return to protection.

We can also examine the effect of country size on the average tariff charged, $E(t) = \int_1^{t^B} t^N(\theta, \lambda) f(\theta) d\theta + (1 - F(\theta^B)) t^N(\theta^B)$. Differentiating with respect to $\theta^B$ yields

$$E_\theta^B(t) = \int_1^{t^B} t^N(\theta, \lambda) f(\theta) d\theta + (1 = F(\theta^B) \frac{dt^B}{d\lambda}$$

The first term must be positive, because an increase in country size must raise the tariff in the region where the binding does not hold. The second term will be negative if the binding is smaller for larger countries. In the neighborhood of $\lambda = 0$ the average tariff must be increasing in country size, since the second term will be arbitrarily small. The average will also be increasing in country size if the binding is increasing in country size. However, the result will be ambiguous if a larger country has a lower binding.

### 4.2 An Example

We can illustrate the relationship between country size and the optimal binding for a specific functional form for the distribution of the political shock. Let $f(\theta) = 2 * (\bar{\theta} - \theta)/(\bar{\theta} - 1)^2$, where $\bar{\theta} \in [1, \theta_{max}]$. This distribution provides a declining
probability of high shocks, and yields an expected value for the magnitude of the political shock that is linear in $\theta^B$,

$$E(\theta - 1|\theta \in [\theta^B, \bar{\theta}]) = (\bar{\theta} + 2\theta^B - 3)/3$$

(14)

Evaluating the necessary condition for an interior solution, (11), using this distribution yields

$$\frac{(\bar{\theta} + 2\theta^B - 3)}{3} = \frac{(\theta - 1)(1 + \beta) + 2\lambda(\beta - 1)}{(1 + \beta)(1 + \lambda)}$$

(15)

In order for the second order conditions to be satisfied at an interior solution, we must have $\bar{R}_{\theta} > E_{\theta}$, which requires $\lambda < 1/2$.

For $\lambda > 1/2$, the second order conditions are not satisfied at an interior solution so the only possible solutions are corner solutions. If $R(t^N(\bar{\theta})) > \bar{\theta} - 1$, then the marginal cost of raising the binding exceeds the marginal benefit for all $\theta \in [1, \theta_{max}]$ and the optimal binding will be less than $t^N(1)$. If $R(t^N(1)) < (\bar{\theta} - 1)/3$, then marginal benefit exceeds marginal cost for all $\theta \in [1, \theta_{max}]$ and the country is allowed complete flexibility in its setting of the tariff. Since $R(t^N(\theta_{max})) = \theta_{max} - 1$, the former case will apply for all $\lambda > 1/2$. This yields a corner solution in which the tariff binding is the solution to $R(t^B) = E(\theta - 1|\theta \in [1, \bar{\theta}])$, which yields

$$t^B = \frac{\bar{\theta} - 1}{7(1 + \beta(1 - \lambda) + 5\lambda - (1 - \lambda)(1 + \beta)\bar{\theta}}$$

(16)

This binding is increasing in $\bar{\theta}$ and $\lambda$, decreasing in $\beta$.

For $\lambda < 1/2$, we have 3 possibilities: an interior solution, a corner solution with $\theta^B = 1$ and a corner solution with $\theta^B = \bar{\theta}$. A corner solution with $\theta = \bar{\theta}$ occurs if $R(t^N(\bar{\theta})) \leq (\bar{\theta} - 1)$, because the marginal benefit of increasing the binding exceeds the marginal cost for all $\theta \in [1, \theta_{max}]$. In order for complete flexibility to be optimal, the country must be sufficiently small that its tariff has minimal external effect, which in the present model requires that $\lambda = 0$. This follows from the fact that $R(\theta) = \theta - 1$ when $\lambda = 0$, which means that the condition for an interior solution at $\bar{\theta}$. Since $R(\theta)$ is increasing in $\lambda$, we must have $\theta^B < \bar{\theta}$ for $\lambda > 0$. A corner solution with $\theta^B = 1$ occurs if $R(t^N(1)) \geq (\bar{\theta} - 1)/3$. The threshold value of
\( \lambda \) for which this holds is given by

\[ \lambda_U = \frac{(1 + \beta)(\bar{\theta} - 1)}{7\beta - 5 - \bar{\theta}(1 + \beta)} \]

\( \lambda_U \) represents the largest country size for which some flexibility is allowed in the setting of tariffs: for \( \lambda > \lambda_U \), we are at a corner solution with binding given by 16). Note that the maximum country size for allowing flexibility to be optimal, \( \lambda^L \), is increasing in \( \bar{\theta} \) and approaches 1/2 as \( \bar{\theta} \) approaches \( \theta_{\text{max}} \).

For \( \lambda \in (0, \lambda^U) \), the binding will be at an interior solution where (15) is satisfied. Solving for the threshold political shock and the corresponding tariff binding \( t^B = t^N(\theta^B, \lambda) \) yields

\[ \theta^B = \frac{(1 + \beta)\bar{\theta}(1 + \lambda) - (9\beta - 3)\lambda}{(1 + \beta)(1 - 2\lambda)} ; \quad t^B = \frac{(\bar{\theta} - 1)(1 + \beta) - 4\lambda(\beta - 1)}{(1 + \beta)(3 - 7\lambda + (1 - \lambda)(\beta(3 - \bar{\theta}) - \bar{\theta}))} \]

The threshold value, \( \theta^B \) is decreasing in \( \lambda \) as noted above. The binding, \( t^B \), will be decreasing in \( \lambda \) for \( \theta < \theta_{\text{max}} \). Figure (3) shows the relationship between the binding and country size for the case where \( \beta = 2 \) and \( \bar{\theta} = 4/3 < \theta_{\text{max}} \), which yields \( \lambda^U = .2 \). The binding is monotonically decreasing in the size of the country for \( \lambda < 0.2 \). The average tariff imposed by a country is non-monotonic - it initially increases and then decreases.

## 5 Safeguards

In this Section we extend the model by introducing a simple model of escape clause, or safeguards, as an additional flexibility mechanism that can be combined with the tariff bindings. We adopt a definition of safeguards that is close to the notion of safeguards in the WTO agreement. In particular, we assume that if an importing country can provide convincing evidence regarding its political economy conditions, the WTO may authorize this country to increase its tariff to the politically efficient level, which may be above the agreement binding.

A central assumption in our model is that providing evidence regarding a country’s state of the world is costly. This assumption reflects the costs associated with the procedure of approving a safeguard measure, which includes required investi-
Figure 3: Binding level (thick dots) and average binding (small dots) as a function of country size. ($\beta = 2$ and $\bar{\theta} = 4/3$)
gations by the importing country, and the dispute settlement process in case the proposed measure is challenged.

Formally we assume that:

1. The importing country can reveal its private information by incurring a state-verification cost of \( c \).

2. When the state of the world is revealed, the importing country will be authorized to apply the politically efficient tariff \( t^E(\theta) \) if that tariff leads to a higher level of world welfare than the current binding.\(^8\) This requires

\[
W(t^E(\theta), \theta^S) - W(t^B, \theta) - c = 0
\]

for all states where the safeguard is used.

3. If no monitoring cost is incurred, the tariff must be no greater than the binding, \( \bar{t} \).

It will only be in the interest of the importing country to verify its binding if

\[
V^M(t^E(\theta), \theta) - V^M(t^B, \theta) - c = 0
\]

This incentive compatibility condition is clearly not satisfied for \( \theta \leq \theta^B \), since the importer is already imposing its optimal tariff. For \( \theta > \theta^B \), the bound tariff is less than optimal so welfare must be increasing in \( t \). Therefore, a necessary condition for (19) to hold is that \( t^E(\theta) > t^B \).

**Lemma 1** If the safeguard mechanism is used for any states of the world, there will exist a threshold state \( \theta^S \) satisfying

\[
W(t^E(\theta^S), \theta^S) - W(t^B, \theta^S) - c = 0
\]

\(^7\)Here we assume that all the procedural costs associated with a safeguard provision are incurred by the importing country. However, it is straightforward to study the case where the exporting country and the WTO also incur procedural costs when a safeguard is proposed.

\(^8\)More generally, given the realized state of the world, the WTO can assign a state-contingent tariff that is potentially different from the politically efficient tariff. Moreover, the evidence provided by the defending country may not eliminate the information asymmetry completely. But as an initial step we assume that the evidence provided by the importing country eliminates the information asymmetry and that the WTO chooses the ex post efficient tariff.
Figure 4: Optimal combination of safeguards and tariff bindings.

such that the safeguard is utilized for all $\theta \in [\theta^S, \bar{\theta}]$.

As a result of Lemma 1, the expected world welfare under an agreement with a tariff binding $t^B$ and a safeguard system with resource cost $c$ can be written as

$$
\int_{t^N(1)}^{t^B} W(t^N(\theta); \theta) f(\theta) d\theta + \int_{\theta^B}^{\theta^S} W(t^B; \theta) f(\theta) d\theta + \int_{\theta^S}^{\bar{\theta}} (W(t^E(\theta); \theta) - c) f(\theta) d\theta \quad (21)
$$

The efficient agreement is obtained by choosing $t^B$ and $\theta^S$ to maximize (21).

The necessary condition for choice of $\theta^S$ is given by (20), and the locus of values of $t^B$ and $\theta^S$ satisfying this condition can be represented as the SS locus in Figure (4). If $c = 0$, then the condition is satisfied with $t^B = t^E(\theta^S)$. For $c > 0$, then $t^B < t^E(\theta^S)$ and the SS locus must lie below the efficient tariff schedule as illustrated in Figure (4). In particular, this schedule must have a positive horizontal intercept for $c > 0$. 

18
The slope of the SS locus is

\[ \frac{dt^B}{d\theta^S} = \frac{\pi(t^E(\theta^S)) - \pi_\theta(t^B)}{W_t(t^B, \theta^S)} \]

For \( t^B < t^E(\theta^S) \), the numerator and denominator of this expression will both be positive, so the SS locus must be upward sloping. A higher value of the binding reduces the incentive to declare a safeguard action in the presence of a large political shock, because the binding provides greater flexibility. Note also that this locus must also lie below the \( t^E(\theta^S) \) line, since the optimal binding is below the efficient tariff at \( \theta^S \).

As in the case without a safeguard, the optimal choice of binding may be at an interior solution or at a corner solution. For the case of a corner solution, which holds for \( t^B < t^N(1) \), the necessary condition for choice of \( t^B \) will be

\[ E(\theta - 1|\theta \in [1, \theta^S]) = R(t^B, \lambda) \] (22)

This expression modifies the necessary condition from the case without safeguards to reflect the fact that the binding does not hold in the region where the safeguard is utilized. Note however that since \( \lim_{\theta^S \to 1} E(\theta - 1|\theta \leq \theta^S) = 0 \), there will exist \( \theta^S \) sufficiently close to 1 that (22) holds for \( t^B < t^B(1) \) when \( \lambda > 0 \). The locus of values satisfying (22) is shown by the BB locus in Figure (4) for \( t^B \leq t^N(1) \). This locus will be upward sloping with slope

\[ \frac{dt^B}{d\theta^S} = \frac{\int_1^{\theta^S} (\theta^S - \theta)f(\theta)d\theta}{-R_t(t, \lambda)F(\theta^S)^2} \] (23)

An increase in the safeguard threshold expands the region for which the binding applies, which raises the value of the binding in transferring income to special interests. As a result, the optimal tariff binding is increased.

At an interior solution where there is tariff overhang in some states of the world, \( t^B = t^N(\theta^B) \). Inverting this condition, we can express the threshold value at which the binding holds as \( \theta^B = h(t^B) \). The necessary condition for choice of \( t^B \) will be

\[ E(\theta - 1|\theta \in [h(t^B), \theta^S]) = \tilde{R}(h(t^B), \lambda). \] (24)
The locus of values satisfying (24) is shown in Figure (4) as the portion of the \(BB\) locus above \(t^N(1)\). Totally differentiating at an interior solution yields

\[
\frac{dt^B}{d\theta^S} = \frac{E_{\theta^S}(\theta - 1|\theta \in [h(t^B), \theta^S])}{E_{\theta^B}(\theta - 1|\theta \in [h(t^B), \theta^S])}h_{t^B}(t^B) - R_t(t^B). \tag{25}
\]

The numerator of this expression is positive, because an increase in the safeguard threshold raises the expected return to transfers to special interest under the binding. The denominator of this expression must be positive at an interior solution as noted in the previous section. Therefore, the portion of the \(BB\) locus will also be upward sloping where there is an interior solution with positive overhang as illustrated in Figure (4). Higher values of \(\theta^S\) raise the expected value of the political shock in the region where there is no safeguard, which results in a higher binding and more overhang.

An intersection of the \(BB\) and \(SS\) loci is a point at which the necessary conditions for choice of \(t^B\) and \(\theta^S\) are both satisfied. The sufficient conditions will also be satisfied if the \(SS\) locus is steeper than the optimal agreement. These observations can be used to derive some features of the optimal trade agreement, and to illustrate how the introduction of the possibility of safeguards affects the choice of binding.

In the absence of a safeguard, the optimal binding will be the point on the \(BB\) locus associated with \(\theta^S = \bar{\theta}\). If the introduction of the possibility of a safeguard results in an interior solution where safeguards are used, then the tariff binding will be reduced. This illustrates how safeguards substitute for tariff overhang in a trade agreement. This could result in a reduction in the amount of overhang in the trade agreement, or in a switch from an agreement with overhang to one where the binding always holds. Note however that as long as \(c > 0\), the optimal agreement will involve a positive tariff.

References


