Cap and Escape in Trade Agreements

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Abstract

We characterize the optimal tariff bindings and escape clause safeguards in a trade agreement among asymmetric countries that are subject to idiosyncratic political-economy shocks. We assume that shocks are private information, and that escape clauses allow the use of a costly monitoring technology to reveal the true value of the private information. We define a concept of convergence of tariff preferences, and show that bindings are higher for countries whose preferences are less convergent and for countries with a lower degree of market power. We also show how the introduction of contingent protection will substitute for tariff overhang, and establish that a sufficient condition for contingent protection to eliminate the use of tariff overhang is that tariff preferences be globally convergent.

1 Introduction

It has been long recognized that a successful trade agreement should provide flexibility to the member governments in choosing their trade policies, because governments want to have the ability to respond to political pressure in exceptional situations. On the other hand, excessive flexibility in a trade agreement undermines the commitment of countries to reduce tariffs. The WTO agreement deals with this trade-off by providing two main types of flexibility mechanism. One type of flexibility arises from the fact that commitments in

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For example, Barton, Goldstein, Josling, and Steinberg (2006) (p.109) note that the US Congress insisted on a safeguards procedure as part of the GATT.
the agreement are provided in the form of tariff bindings, which commit countries to impose a tariff that is no higher than its binding. The difference between the bound tariff and the applied tariff rate, referred to as “tariff overhang,” provides a measure of the amount by which a country can unilaterally raise its tariff without violating its WTO commitments. A second form of flexibility comes in the form of “escape clauses,” which allow countries to raise their tariffs if certain conditions are met. In contrast to the flexibility provided by tariff overhang, the use of escape clauses allows a country to exceed its binding but also requires that the country conduct an investigation (which are subject to challenge in the WTO dispute settlement process) to establish that the conditions for providing the escape have been met.

The purpose of this paper is to develop a model that allows for the simultaneous use of both tariff overhang and escape clauses as part of a trade agreement. We work within a simple political-economy trade model in which governments are uncertain about their future preferences over trade policy, so that the country’s optimal tariff varies with the magnitude of a political shock. We adopt an incomplete contracting approach in which the magnitude of the political shock, and hence the importer’s preferred tariff, is the private information of the importing country. However, the importing country can make the value of its private information known to the rest of the world by incurring a monitoring cost.

Using this framework, we examine the optimal “cap and escape” agreement which has features similar to that of the WTO trade agreement. The cap part of the agreement specifies a tariff binding that allows the country to unilaterally choose any tariff less than or equal to the binding. The escape portion of the agreement allows the country to exceed the binding if the magnitude of the political shock is verified to exceed a threshold level. The magnitude of the shock is verified through a costly state verification process. The threshold level of the shock at which the importer can escape its bound tariff, as well as the magnitude of the tariff that can be imposed when the value of the shock is revealed, are specified as

2 Antidumping duties provide another form of contingent protection. Antidumping duties differ in that they are not necessarily imposed on an MFN basis. Since we are working in a two-country setting, we do not distinguish between MFN and non-MFN measures in our analysis.

3 Another type of flexibility may be provided through a remedy system in which a party is allowed to breach the contract if it provides appropriate compensations to the affected parties. For a discussion of breach remedies in trade agreements see Posner and Sykes (2011), Beshkar (2010a), and the papers cited in the next footnote.

4 Other models, including Beshkar (2010b, 2011), Maggi and Staiger (2011), and Park (2011), examine state verification processes that generate only an imperfect, albeit informative, signal of the state of the world. However, these models do not imply a role for tariff overhangs in trade agreements.
part of the trade agreement. The monitoring that takes place when the importer escapes
the tariff binding can be interpreted as the investigative processes required to approve
and implement contingent protection under the GATT/WTO agreements. The dispute
settlement process of the WTO may be considered as another mechanism for monitoring
of the contingencies.

Our analysis is related to several strands of recent work that uses an incomplete con-
tracts approach to modeling trade agreements. Bagwell and Staiger (2005) have shown
that the use of a weak tariff binding, which allows a country to choose its tariff at or below
the binding, can yield a higher expected welfare than can be obtained by an inflexible tariff
rate. Subsequently, Amador and Bagwell (2011) derived conditions under which the use
of a tariff binding will be the optimal incentive compatible agreement Our work extends
their analysis in two ways. First, we use a model with asymmetric countries, which allows
us to derive testable implications about the relationship between country characteristics
and the optimal amount of tariff overhang. This is of interest because there is substantial
variation across countries in the amount of overhang in tariff lines. Second, the existing
work on tariff bindings does not allow for the potential interactions between tariff bindings
and contingent protection. Nevertheless, contingent protection measures along with weak
bindings are two important components of flexibility mechanisms in the WTO agreement.
Our work is the first to allow for the use of both bindings and escape clauses as part of
optimal agreements, and to relate the usage of the respective types of flexibility to country
characteristics.

Our approach is also related to works that examine the effect of transactions costs
have shown that when writing a contract is costly, it is optimal to craft an incomplete

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5 The models we consider are closely related to the literature on optimal delegation (e.g., Holmstrom
1984, Melumad and Shibano 1991 and Alonso and Matouschek 2008), which has shown that it may be
optimal for a principal to require a privately-informed agent to choose from a restricted set of actions when
contingent transfers are not possible.

6 Almost 2/3 of the tariff lines of 69 WTO members are below their bound rates. The average level of
tariff binding overhang, which is the difference between the bound rate and the applied rate, is 25 percentage
points or more than a quarter of the bound rates. However, there is no overhang in more than 90% of tariff
lines for the US, European Union, China, and Japan. Thus, the usage of tariff overhang as a flexibility
mechanism varies widely across countries.

7 Between 1995 and 2010, a total of 216 safeguard actions and more than 2400 antidumping measures
have been notified to the WTO. The importance of contingent protection measures as an element of trade
agreements was highlighted in the Doha round of WTO negotiations in which most developing countries
demanded the inclusion of a safeguard clause in the agreement as a condition to accept trade liberalization
in agricultural sectors.
contract in order to save on the ex ante contracting efforts. Our analysis differs in that we emphasize the ex post costs of implementing the contract, which includes the costs of verifying the contingencies that are mentioned in the contract. We find that, due to the costs of implementing a contingent contract, it is optimal to write an incomplete contract that gives discretion to the parties in some contingencies.

Our approach, therefore, provides a distinct and novel rationale for writing an incomplete contract (such as tariff bindings) on the basis of the cost of implementing, rather than writing, the agreement. Implementing a complete agreement, which maps each possible contingency to a set of actions to be taken by the signatories, requires the parties to find a mutual agreement on the nature of the prevailing contingency in each period over the lifetime of the agreement. This requires establishing appropriate procedures for investigation of the contingencies in each member country as well as a dispute settlement process to handle potential disputes over the result of these investigations. Implementation of these procedures are potentially very costly as they involve hiring arbitrators, lawyers, and government representatives. To the best of our knowledge, the previous literature has not explored the impact of the implementation costs on the optimal design of a trade agreement.

Our approach is similar to that of models with costly state verification, notably Townsend (1979), where an agent’s private information can be observed by the uninformed party through a costly monitoring. The optimal contracts in this literature typically involve two regions: a monitoring region in which the true type is revealed and the efficient action for that type is taken, and a non-monitoring region in which agents pool and all take the same action. A novel result of our cap-and-escape model is that optimality involves giving countries ‘discretion’ in choosing their policy in the non-monitoring region, such that different types may not pool in the equilibrium.

We begin by deriving the optimal tariff binding in the absence of contingent protection. We show that the cost of allowing flexibility through tariff overhang is greater for countries with a larger degree of market power. In order to provide flexibility when the magnitude of the shock is private information, the binding must be larger than the country’s optimal tariff when the shock is at its lowest level. Since this level is greater for countries with greater market power, countries with greater market power will have lower tariff bindings. We

\footnote{Note that in contrast to implementation costs, the cost of composing a contract is a one-time expense. The fact that the cost of state verification is a recurring cost over the lifetime of the agreement, multiplies the importance of designing a contract that saves on implementation costs.}
also introduce the concept of local convergence of preferences, which holds if the difference between the importer’s optimal tariff and the world’s optimal tariff gets smaller as the political weight increases, and show that a country will be provided less flexibility if the degree of convergence increases.

We then characterize the optimal cap-and-escape agreement in which the agreement can use both tariff bindings and contingent protection as flexibility mechanisms. We show that agreements with tariff bindings create an incentive to include an escape clause, because both importing country and world welfare will be raised by increasing tariffs for the highest realizations of the political shock. An escape clause in an optimal agreement will specify the first best tariff when monitoring occurs, although the threshold specified in the agreement to allow escape will exceed the level that is preferred by the importing country.

We also establish that contingent protection is a substitute for tariff overhang, because it will result in a reduction in the tariff binding in the optimal trade agreement. In particular, the use of contingent protection will result in the elimination of tariff overhang if the importing country’s preferences converge monotonically to that of the world as the value of protection increases for the importing government. We use simulations to show that tariff overhang and monitoring may exist simultaneously in an optimal agreement if preferences are locally divergent. The simulations also indicate that monitoring will be most valuable for relatively large countries, for whom the use of tariff overhang to provide flexibility is very costly.

Section 2 presents the trade model and characterizes the first best trade agreement when there is full information about the value of the political shocks. Section 3 characterizes the optimal tariff bindings when there is private information about political shocks. Section 4 introduces the possibility of contingent protection in the form of a binding agreement with an escape clause, and examines the interactions between tariff bindings and contingent protection in an optimal agreement. Section 5 offers some concluding remarks. Proofs are provided in the Appendix A.

2 The Basic Model

We examine a two-good, two-country trade model in which countries are asymmetric in size. We assume that industries are perfectly competitive, and that governments choose tariff policy to maximize a weighted social welfare function that reflects the political influence of producers in the import-competing sector. In this setting, the motivation for forming
a trade agreement is to resolve the Prisoner’s dilemma created by the terms of trade externality from tariffs as in Bagwell and Staiger (1999). The asymmetry in country size is introduced in a manner similar to that in Bond and Park (2002).

The home country demand for good $i$ is given by $d_i = \lambda (1 - p_i)$ for $i = 1, 2$, where $p_i$ is the price of good $i$ and $\lambda \in (0, 1)$ is the relative size of the home country. Foreign country demands are $d_i^* = (1 - \lambda)(1 - p_i^*)$. Home supply is $x_1 = \lambda p_1$ for good 1 and $x_2 = \lambda \beta p_2$ for good 2, while foreign supplies are $x_1^* = (1 - \lambda)\beta p_1^*$ and $x_2^* = (1 - \lambda) p_2^*$. We assume that $\beta > 1$, so the autarky prices will satisfy $p_1 = p_2^* = 1/2 > p_1^* = p_2 = 1/(1 + \beta)$. Parameters $\lambda$ and $\beta$ can be interpreted, respectively, as the relative size of the home country, and the comparative advantage of the exporting country in its exportable sector.

Letting $t (t^*)$ be the ad valorem tariff imposed by the home (foreign) country on imports of good 1 (2), we have $p_1 = p_1^* (1 + t)$ and $p_2 = p_2 (1 + t^*)$ 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’s importable follows immediately. The home excess demand function for good 1 is $m = \lambda (1 - 2p_1)$, and foreign excess demand is $m^* = (1 - \lambda)(1 - (1 + \beta)p^*)$. The market clearing price of good 1 in the respective countries will be

$$p^*(t) = \frac{1}{2\lambda (1 + t) + (1 + \beta)(1 - \lambda)}, \quad p(t) = \frac{1 + t}{2\lambda (1 + t) + (1 + \beta)(1 - \lambda)} \tag{1}$$

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 $t^\text{pro} = \frac{\beta - 1}{2}$.

We can use the inverse of the foreign elasticity of export supply,

$$\frac{1}{\varepsilon^*} = \frac{\lambda (1 + \beta - 2t)}{1 + \beta}, \tag{2}$$

Note that this model of comparative advantage can be derived from a general-equilibrium model with a third good that absorbs all income effects. Let the home country consist of a measure of $N$ identical households with each household having a utility function $U = \sum_{i=1,2} d_i (1 - 0.5d_i) + d_0$. Households have an endowment of labor that can be allocated to production of the three goods. Letting $l_i$ denote the quantity of labor allocated to good $i$, the production functions are $x_0 = l_0$, $x_1 = (2l_1)^5$ and $x_2 = (2\beta l_2)^5$. Similarly, the foreign country is assumed to have $N^*$ households with the same preferences and production functions $x_0^* = l_0^*$, $x_1^* = (2\beta l_1^*)^5$, and $x_2^* = (2l_2^*)^5$. Choosing good 0 as numeraire and letting $\lambda = N/(N + N^*)$, this structure yields the demand and supply functions in the text if the supply of labor is sufficiently large that good 0 is always produced.
to characterize the home country’s market power in its import markets. Market power is positive for \( t < t^{\text{pro}} \), and is increasing in the home country’s relative size, \( \lambda \), and its degree of comparative disadvantage, \( \beta \). Note however that there is an important difference in the effect of these two parameters on market power. The marginal effect of country size on market power declines as \( t \) increases, because market power goes to 0 as the tariff approaches the prohibitive level. Since the prohibitive tariff is independent of market size, the marginal effect of country size goes to 0 as the prohibitive tariff is approached. In contrast, the marginal effect of increases in \( \beta \) on market power increases as \( t \) rises because the prohibitive tariff is increasing in \( \beta \). This distinction in market power effects will play an important role in the analysis below.

2.1 National Objective Functions

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 \( 1 + \theta \) on the welfare of producers in the import-competing sector and a weight of 1 on the welfare of all other agents, where \( \theta \geq 0 \). Home country consumer surplus is given by \( S(t) = \lambda(1 - p(t))^2/2 \), producer surplus by \( \pi(t) = \lambda p(t)^2/2 \), and tariff revenue by \( tp^*m(t) = tp^*\lambda(1 - 2p) \).

\[
V(t, \theta) = S(t) + (1 + \theta) \pi(t) + tp^*m(t)
\] (3)

Increases in \( t \) have a favorable effect on welfare by improving the terms of trade and transferring income to domestic producers of import-competing goods (when \( \theta > 0 \)). However, increases in \( t \) also reduce trade volume, which is welfare reducing when the domestic price exceeds the world price for importables. As a result of these trade-offs, home country welfare is strictly quasi-concave in \( t \) for \( t \in [0, t^{\text{pro}}] \). The unique optimal tariff that maximizes \( V(t) \) is given by

\[
t^N(\theta) = \frac{\theta (1 + \beta) + 2 (\beta - 1) \lambda}{(2 - \theta) (1 + \beta) + 4 \lambda}.
\] (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. We let \( \theta^{\text{max}} = 2(\beta - 1)/(1 + \beta) < 2 \) denote the value of the political shock at which the home country’s optimal tariff eliminates trade, \( t^N(\theta^{\text{max}}, \lambda) = t^{\text{pro}} \).

\(^{10}\) The impact of \( t \) on home welfare is \( V_t = \frac{\lambda(1 + \beta)(1 - \lambda)(\theta(1 + \beta) + 2(\beta - 1)\lambda - t(2 - \theta)(1 + \beta) + 4\lambda)}{(\beta(1 - \lambda) + \lambda(1 + 2\theta)(1 + \beta)^2)} \). National welfare is increasing for \( t < t^N(\theta) \) and decreasing for \( t > t^N(\theta) \), so \( V \) is strictly concave in \( t \) for \( t \in [0, t^{\text{pro}}] \).
The following characteristics of the importer’s optimal tariff function follow immediately from differentiation of (4) and will be useful in the analysis below.

**Lemma 1** For \( \theta < \theta_{\text{max}} \) and \( \lambda \in (0, 1) \),

(i) \( \frac{\partial N(\theta)}{\partial \theta} > 0 \),

(ii) \( \frac{\partial N(\theta)}{\partial \beta} > 0; \frac{\partial N(\theta)}{\partial \lambda} > 0 \),

(iii) \( \left( \frac{\partial N(\theta)}{\partial \beta} / \frac{\partial N(\theta)}{\partial \lambda} \right) \) is increasing in \( \theta \).

Part (i) shows that a higher political weight on the profits of import-competing producers raises the optimal tariff. Part (ii) captures the role of market power on the optimal tariff. A larger home country size and a greater degree of comparative disadvantage for the home country will decrease the elasticity of the export supply function facing the home country, resulting in a larger optimal tariff. Part (iii) highlights the distinction in market power effects of increases in \( \lambda \) and \( \beta \) on the optimal tariff. Since the effect of \( \beta \) on market power is increasing in \( t \) and the effect of \( \lambda \) on market power is decreasing in \( t \), the effect of \( \beta \) on the optimal tariff increases relative to the effect of \( \lambda \) as \( \theta \) increases.

For the foreign country, consumer surplus is \( S^*(t) = (1-\lambda)(1-p^*(t, \lambda))^2/2 \) and producer surplus is \( \pi^*(t) = (1-\lambda)\beta p^*(t)^2/2 \). Foreign welfare will be

\[ V^*(t) = S^*(t) + \pi^*(t), \]  

which is decreasing and convex in \( t \). An increase in the home tariff worsens the terms of trade for the foreign country. The convexity of foreign welfare arises because the adverse terms of trade effect is proportional to the volume of foreign exports, and the volume of exports declines with increases in \( t \).

World welfare in the home country importable sector is the sum of home and foreign country welfare, \( W(t, \theta) = V(t, \theta) + V^*(t) \). World welfare will be quasiconcave in \( t \) for \( \theta \in [0, \theta_{\text{max}}] \), and achieves a maximum at \(^{11} \)

\[ t^E(\theta) = \frac{\theta}{2-\theta}. \]  

\(^{11}\)Derivative of the world welfare with respect to tariff is \( W_t = \frac{\lambda(1+\beta)(1-\lambda)(\theta - t(2-\theta))}{(\beta(1-\lambda)+\lambda(1+2\beta+1))} \). As is clear from this expression, world welfare is increasing for \( t < \frac{\theta}{2-\theta} \) and decreasing for \( t > \frac{\theta}{2-\theta} \). Therefore, \( W \) is quasiconcave and \( t^E(\theta) \) is the jointly optimal tariff.
The efficient tariff will be positive for $0 < \theta \leq \theta^\text{max}$ because world welfare incorporates the importing country’s preference to protect its producers. At $\theta = \theta^\text{max}$, the weight on producer interests is sufficiently high that the efficient tariff eliminates trade. The difference between the Nash tariff and the efficient tariff, which we denote by $\Delta(\theta) \equiv t^N(\theta) - t^E(\theta)$, is positive for $\theta \in (0, \theta^\text{max})$ and $\lambda \in (0, 1)$ because the home country fails to internalize the terms of trade externality it imposes on the foreign country. Since $t^E(\theta)$ is independent of the market power parameters, $\Delta(\theta)$ is increasing in $\beta$ and $\lambda$ by Lemma $\text{I}$ (ii). 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. $t^N(\theta^\text{max}) = t^E(\theta^\text{max})$ and $\lim_{\lambda \to 0} t^N(\theta) = t^E(\theta)$).

We will assume that $\theta \in \Theta \equiv [\theta, \overline{\theta}]$, where $\theta \geq 0$ and $\overline{\theta} \leq \theta^\text{max}$. Although the market power effect must go to zero as trade is eliminated, this does guarantee that the preferences of the importing country and the world will become more aligned as the political shock increases in value on $\Theta$. This point is illustrated in Figure $\text{I}$ which shows the relationship between $t^N(\theta)$ and $t^E(\theta)$ for $\Theta = [0, 2/3]$ and $\lambda = .3$. When $\beta = 2$, $\Delta'(\theta) < 0$ for all $\theta \in \Theta$, a property we will refer to as ‘globally convergent’ preferences. In particular, the market power effect goes to zero in at the upper bound of the interval shown in Figure $\text{I}$ because $\theta^\text{max} = 2/3$ for $\beta = 2$. In contrast, $\Delta'(\theta) > 0$ for all $\theta \in \Theta$ when $\beta = 10$. The possibility that $\Delta'(\theta) > 0$ for some values of $\theta$ is related to the observation above that the impact of $\beta$ on market power increases as the tariff rises. Since $\theta^\text{max} = 18/11$ for $\beta = 10$, the tariff does not approach the prohibitive value on $\Theta$ in Figure $\text{I}$.

Converging preferences imply that the protectionist bias of the importer’s tariff policy decreases as the political shock increases in value. This property will play an important role in determining the types of flexibility that arise in the optimal cap and escape agreement, so it will be useful to provide some conditions under which preferences converge. We say that the preferences of the importer and the world are ‘locally convergent’ at $\theta$ if $\Delta'(\theta) < 0$.

**Lemma 2 (Convergence of Preferences)** Defining $\bar{\beta}(\theta) \equiv \frac{2+\theta+4\sqrt{1+\lambda}}{2-\theta}$,

(i) The preferences of the importer and the world are locally convergent at $\theta$ (i.e., $\Delta'(\theta) < 0$) iff $\beta < \bar{\beta}(\theta)$. For $\beta < \bar{\beta}(0) = 1 + 2\sqrt{1+\lambda}$, preferences are globally convergent.

(ii) Consider $d\beta > 0$ and $d\lambda < 0$ such that $\int_{\theta_0}^{\overline{\theta}} \Delta f(\theta) d\theta$ remains constant for some $\theta_0 \in [\theta, \overline{\theta})$. There exists some $\theta_1 \in (\theta_0, \overline{\theta})$ such that $\Delta(\theta)$ decreases for $\theta \in [\theta_0, \theta_1)$ and increases for $\theta \in (\theta_1, \overline{\theta})$.

9
Figure 1: Convergence of Tariffs with \( \lambda = .3 \) and \( \Theta = [0, 2/3] \)
Part (i) of this Lemma shows that for the preferences to be convergent, the comparative advantage parameter, \( \beta \), must be sufficiently small. Notably, if \( \beta > 1 + 2\sqrt{1 + \lambda} \), there will exist a range of \( \theta \) such that the home country’s optimal tariff will increase more rapidly than the efficient tariff as the political shock increases. For the parameter values used in Figure 1, there will be global divergence on \([0, 2/3]\) for \( \beta > \tilde{\beta}(2/3) = 5.42 \) and global convergence for \( \beta < 3.28 \) For \( \beta \in (3.28, 5.42) \), the tariff schedules will be locally divergent for \( \theta \in [0, \tilde{\beta}^{-1}(\beta)) \) and locally convergent for \( \theta \in (\tilde{\beta}^{-1}(\beta), 2/3) \).

Part (ii) of Lemma 2 shows that an increase in \( \beta \) and a corresponding reduction in \( \lambda \) that keeps the average difference between importer and world preferences constant for \( \theta > \theta_0 \) will “rotate” the \( \Delta(\theta) \) schedule around some point on the interval \( \theta \in (\theta_0, \tilde{\theta}) \), making the preferences of the importer less convergent with that of the world as a whole on that interval. This result is due to the observation in Lemma (iii) that the market power effect of \( \beta \) rises relative to that of \( \lambda \) as \( \theta \) increases.

We assume that the home country’s political parameter has a distribution \( f(\theta) \) on \( \Theta \). Similarly, there is a distribution of foreign political shocks \( f^*(\theta^*) \) and Nash equilibrium tariffs for the foreign country in the market for good 2, \( t^N(\theta^*) \), derived as above for the home country. In the absence of a trade agreement, countries will impose state contingent tariffs \( \{t^N(\theta), t^N_v(\theta^*)\} \). Since countries ignore the adverse terms of trade effect on the foreign country in setting their tariffs, gains from reciprocal trade liberalization will exist in each state of the world.

We will assume that countries can make lump sum transfers in the negotiations for the formation of a trade agreement. Countries will then negotiate a trade agreement whose tariff schedule maximizes expected world welfare, with transfers determining the split of the gains from the agreement between countries. The home country tariff schedule that maximizes world welfare will be the solution to

\[
\max_{t(\theta)} EW = \int_0^{\tilde{\beta}} W(t(\theta); \theta) f(\theta) d\theta \tag{7}
\]

The solution to this problem will call for setting the state contingent efficient tariffs from \([0] \) for the home country. Efficient foreign tariffs on imports of good 2 are derived in a similar fashion.

\[^{12}\text{For } \lambda \text{ sufficiently large, the } \text{home country will prefer the Nash equilibrium to free trade as in Syropoulos (2002). In that case, transfers will be necessary to induce participation by the large country.}\]
3 Optimal Tariff Bindings

We now turn to the derivation of the optimal trade agreement for the case where the magnitude of the political shocks is the private information of the importing country. We will assume that the distribution of the political shock in each country is common knowledge, but the realization is observed only by the importing country. We will also assume that state-contingent transfers between countries are not possible.

When the value of the political shock is private information, we can treat the trade agreement problem as maximizing (7) subject to the constraint that \( t(\theta) \) be incentive compatible. Incentive compatibility requires that the importing country not prefer the tariff in any other state to that assigned in state \( \theta \),

\[
V(t(\theta), \theta) - V(t(r), \theta) \geq 0 \text{ for all } r, \theta \in \Theta
\]

The full information agreement \( t^E(\theta) \) will not be incentive compatible for the importing country for \( \theta < \bar{\theta} \), because there will exist \( r > \theta \) that yield a tariff that is preferred to \( t^E(\theta) \).

In solving for the optimal trade agreement, we will restrict attention to trade agreements that take the form of a tariff binding, \( t^B \). A tariff binding allows the importing country to choose any tariff \( t \leq t^B \) without violating the agreement, and can be represented by the incentive compatible tariff schedule

\[
t(\theta) = \begin{cases} 
  t^B, & \text{if } \theta \geq \theta^B(t^B) \equiv \max\{\bar{\theta}, t^N(t^B)\}, \\
  t^N(\theta), & \text{if } \theta < \theta^B(t^B).
\end{cases}
\]

If \( t^B > t^N(\theta) \), there will exist states of the world for which the tariff is strictly less than the binding. We refer to this as a trade agreement with tariff overhang. If \( t^B \leq t^N(\theta) \), the importing country’s tariff will be at the binding for all states of the world and there is no overhang. We limit our attention to agreements with tariff bindings for two reasons. First, this is the type of policy that has been utilized by the GATT/WTO agreements. Second, it has been shown by Alonso and Matouschek (2008) and Amador and Bagwell (2011) in models similar to ours that the optimal incentive compatible agreements will take this form when transfers are not allowed and the preferences and distribution of shocks satisfy certain conditions. We discuss the relationship between our results and these restrictions in more detail below.
The optimal tariff binding agreement is obtained by maximizing (7) subject to (9), which can be expressed as

$$\max_{t^B} E[W] = \int_{\theta}^{\theta^B(t^B)} W(t^N(\theta); \theta) f(\theta) d\theta + \int_{\theta^B(t^B)}^{\theta} W(t^B; \theta) f(\theta) d\theta,$$

where,

$$\theta^B(t^B) = \max\{\theta, t^N^{-1}(t^B)\}. \quad (10)$$

An analogous expression can be derived for the tariff binding for the foreign country.

Noting that $W(t; \theta) = W(t; 0) + \theta \pi(t)$, the necessary condition for optimality can be expressed as

$$\pi_t(t^B) (1 - F(\theta^B(t^B))) \left[ \frac{W_t(t^B, 0)}{\pi_t(t^B)} + E[\theta | \theta > \theta^B(t^B)] \right] = 0 \quad (11)$$

This expression will have two types of solutions: one in which the bracketed expression equals 0 and one where $\theta^B(t^B) = \overline{\theta}$. It can be shown that the latter solution must be a local minimum if $\overline{\theta} < \theta^{\max}$, so we concentrate on the former. The bracketed expression can be interpreted as equating the marginal benefit and marginal cost of raising the binding. The first term is the marginal deadweight loss per dollar of profit generated to domestic producers from raising the tariff. It can be shown using (3) that the marginal deadweight loss is given by $-W_t(t^B, 0)/\pi_t(t^B) = 2t^B/(1+t^B)$, so that the cost of raising the binding is increasing in the level of the binding chosen. The cost of raising the binding is illustrated by the $C(t^B)$ locus in Figure 2.

The second term in the bracketed expression in (11), $E[\theta | \theta > \theta^B]$, is the expected political premium from raising an additional dollar for producers, which is illustrated by the $B(t^B, \lambda)$ loci in Figure 2. For $t^B < t^N(\theta)$, the binding applies for all $\theta$ and the expected benefit is simply the mean of the political shock. For $t^B > t^N(\theta)$, $\frac{\partial E[\theta | \theta > \theta^B(t)]}{\partial t^B} = \frac{(E[\theta | \theta > \theta^B(t)] - \theta^B) f(\theta^B) \frac{\partial \theta^B}{\partial t^B}}{1-F(\theta^B)} > 0$ because increases in the raise the threshold value at which the binding applies.

The necessary condition for an optimal binding is satisfied at the intersection of the $C(t^B)$ and $B(t^B, \lambda)$ in Figure 2. In order for the intersection to be a local maximum, the $C(t^B)$ locus must be steeper than the $B(t^B, \lambda)$ locus at an intersection. Therefore, the
second-order condition for optimality may be written as

$$\frac{2}{(1 + t_B)^2} > \frac{(E[\theta|\theta > \theta^B(t)] - \theta^B) f(\theta^B) \partial \theta^B}{1 - F(\theta^B)} \partial t^B,$$

where, the left-hand side is the slope of $C(t)$ and the right-hand side is the slope of $B(t, \lambda)$ at the intersection of the two schedule. An intersection with $t_B < t_N(\theta)$ will represent a binding without overhang in which case $\frac{\partial B}{\partial t} = 0$ and, thus, the second-order condition (??) is satisfied. An intersection with $t_B \in (t_N(\theta), t_N(\bar{\theta}))$ will be a solution in which there is overhang, since the tariff is below the binding for $\theta < t_N^{-1}(t_B)$. If the solution that satisfies the FOC involves an overhang, $\theta^B$ is strictly increasing in $t_B$ and we have $\frac{\partial \theta^B}{\partial t^B} = \frac{2(\lambda + 1)}{(1 + t_B)^2}$.

Substituting for $\frac{\partial \theta^B}{\partial t^B}$ in condition (12), yields the second-order condition for the case where $\theta^B > \bar{\theta}$:

$$E[\theta|\theta > \theta^B(t_B)] - \theta^B < \frac{1}{1 + \lambda},$$

(13)

The fact that both marginal benefit and marginal cost schedules are upward sloping raises the possibility of multiple solutions to the necessary conditions. In order to simplify
the discussion, we will assume that the pdf for the distribution of political shocks has a power function distribution given by

\[ f(\theta) = \frac{\gamma}{(\bar{\theta} - \theta)^{\gamma-1}} \text{ for } \theta \in [\underline{\theta}, \bar{\theta}] . \]  

(14)

This formulation yields a uniform distribution for \( \gamma = 1 \), with \( f'(\theta) > 0 \) for \( \gamma < 1 \) and \( f'(\theta) < 0 \) for \( \gamma > 1 \). Under this distribution function, the expected political gain from raising the binding is given by

\[ E(\theta | \theta \geq \theta^B) = \frac{\bar{\theta} + \gamma \theta^B (t^B)}{1 + \gamma}, \]  

(15)

which is linear in \( \theta^B \) and, thus, the first-order condition (11) yields a unique solution. Moreover, under the power function distribution, the second order condition (13) will be satisfied iff

\[ \frac{\gamma}{1 + \gamma} < \frac{1}{1 + \lambda} \text{ or, equivalently, } \frac{\lambda}{\lambda + 1} < 1, \]  

which will be satisfied for all \( \lambda \) if \( \gamma \leq 1 \). The second order condition fails only if \( \gamma \) is sufficiently larger than 1, which is associated with a \( f(\theta) \) that declines rapidly in \( \theta \).

The following proposition, which is proven in the Appendix A, characterizes the solutions for the optimal binding when the expected political binding is given by (15) and \( \bar{\theta} < \theta^{\max} \), which ensures that the mean of the political shocks is not too large.

**Proposition 1** Assume that \( \bar{\theta} < \theta^{\max} \) and the distribution of political shocks is given by (14).

(i) If \( \lambda < \tilde{\lambda} = \frac{\bar{\theta} - \underline{\theta}}{(1+\gamma)\theta^{\max} - \bar{\theta} - \underline{\theta}} < \frac{1}{\gamma} \), the optimal agreement will involve a tariff binding with overhang. The tariff binding will be \( t^B = \frac{\bar{\theta} - \gamma \theta^{\max}}{2 - \bar{\theta} - \gamma \lambda / (1 + \beta)} \), which is decreasing in \( \lambda \) and \( \beta \).

(ii) If \( \lambda \geq \tilde{\lambda} \), the optimal agreement will involve a tariff binding with no overhang. The tariff binding will be \( t^B = \frac{E(\theta)}{2 - E(\bar{\theta})} = \frac{\bar{\theta} + \theta^{\max}}{2(\gamma + 1) - (\bar{\theta} + \theta^{\max})} \).

Part (i) provides a closed form solution for the tariff at an interior binding, and shows that it will be a global maximum when the second order condition is satisfied. Part (ii) shows that a binding with no overhang will be optimal in all cases where the second order

\[ \gamma \text{ is sufficiently larger than 1, which is associated with a } f(\theta) \text{ that declines rapidly in } \theta. \]

\[ \text{It is interesting to note that, as shown by Amador and Bagwell (2011), a sufficient condition for tariff bindings to be the optimal form of trade agreements is for } f(\theta) \text{ not to be declining too rapidly in } \theta. \] Therefore, the SOC is also a sufficient condition for tariff bindings to be the optimal form of trade agreements.
conditions fail, or in cases where the second order conditions are satisfied and the country size is sufficiently large. An increase in $\lambda$ or $\beta$ will raise $t^N(\theta)$ by Lemma 1, which reduces the threshold value of $\theta$ at which $t^B = t^N(\theta)$, causing a downward shift in the $B(t^B)$ locus in Figure 2. This reduces the optimal binding at an interior solution. For values of the parameters sufficiently large that the threshold $\lambda$ defined in Proposition 1 is exceeded, there will be a corner solution with no overhang. This establishes that that countries with greater degrees of market power will be provided less flexibility in an optimal trade agreement. Providing tariff flexibility to a large country is more costly than to a small country, because the tariff binding must be sufficiently large that it exceeds $t^N(\theta)$ in order to provide flexibility.

The implications of Proposition 1 for the optimal tariff agreement is illustrated in Figure 3 for a case with $\beta = 2$. The dashed line is the first best tariff schedule and the dotted lines show Nash tariff schedules for $\lambda = .1$ and $\lambda = .3$. The larger country has the higher Nash tariff, but both schedules are locally convergent with the efficient tariff for all $\theta \in [0, \theta_{\text{max}} = 2/3]$. The trade agreement specifies $t(\theta) = t^N(\theta)$ for $\theta < \theta^B(t^B)$ and $t^B$ otherwise. The solid lines in Figure 3 show the agreement schedules satisfying Proposition 1 when the political shock is uniformly distributed on $[0, .5]$. The larger country receives a lower tariff binding, and its tariff will be at the binding for a greater range of political shocks. However, the large country’s market power is reflected in the fact that its tariff is higher for realizations of the political shock where both countries are below their respective bindings.

An unbound tariff, which provides the maximum flexibility to the importer, arises if $t^B = t^N(\theta)$. The formula for the binding at an interior solution provides two limiting cases in which the tariff is unbound, $\lim_{\lambda \to 0} t^B = t^N(\theta)$ and $\lim_{\theta \to \theta_{\text{max}}} t^B = t^N(\theta)$. The first is a case where the importing country is a small country with no market power, so that its tariff has no spillover effects on the rest of the world and the nationally optimal tariff will correspond to the world optimum. The second is the case in which the expected value of the political shock is sufficiently high that political concerns outweigh the spillover from the terms of trade.

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14 In Beshkar, Bond, and Rho 2012 we find empirical evidence supporting the prediction that countries with greater market power will have lower bindings and are more likely to be at the binding.

15 If $\theta > \theta_{\text{max}}$, then $t^B = t^B_{\text{pro}}$ can be a local maximum.
3.1 Convergence of Preferences and the Value of Flexibility

We have already established in Proposition 1 (i) that the optimal level of tariff binding is inversely related to the relative country size, \( \lambda \), and the comparative disadvantage parameter, \( \beta \). These parameters may be considered as measures of market power as they are positively related to the importing country’s inverse export elasticity. Therefore, one may interpret Proposition 1 (i) as reflecting the intuitive flexibility-discipline trade-off: greater market power increases the cost of providing flexibility and, as a result, optimal binding must be inversely related to a country’s international market power.

We can further show that the value of flexibility depends not only on the average level of market power, but also on its convergence properties of the importer’s optimal tariff. Consider a perturbation of the preferences (as in Lemma 2 (ii)) that raises \( \beta \) and reduces \( \lambda \) to keep the expected Nash tariff constant in the region where the tariff is at the binding. This change will reduce \( t^N(\theta^B) \), which has the effect of raising \( \theta^B \) at an interior solution and shifting the benefit schedule upward in Figure 2 at an interior solution. This yields

**Proposition 2** An increase in \( \beta \) and reduction in \( \lambda \) that keeps \( \int_{\theta_B}^{\theta^B} t^N(\theta)f(\theta)d\theta \) constant
will raise the tariff binding in an optimal agreement.

This result indicates that the level of the tariff binding depends not only on the home country’s market power, but also on how convergent the importer’s preferences are to those of the world as \( \theta \) increases.

4 Optimal Agreements with Costly Monitoring

We now consider the possibility that by incurring a monitoring cost of \( c \), the importing country is able to reveal the true value of \( \theta \) to the rest of the world. We can then specify a trade agreement as consisting of two regions: a monitoring region \( (M \subseteq \Theta) \) and a non-monitoring region \( (M^C) \). A country reporting a state in the non-monitoring region is assumed to be subject to a tariff binding, as in the previous section. If the importing country incurs the monitoring cost and a state \( \theta \in M \) is verified, then it receives the tariff \( t^M(\theta) \) that is specified as part of the agreement. If the importer incurs the monitoring cost and the state is revealed to be outside the monitoring region, then it is subject to the binding.

In order for a tariff \( t^M(\theta) \) in the monitoring region to be incentive compatible, the importing country must prefer the payoff it receives from undergoing monitoring to any tariff that it could choose in the non-monitoring region,

\[
V(t(\theta), \theta) - V(t(r), \theta) \geq c \text{ for all } \theta \in M, r \in M^C, \tag{16}
\]

For \( \theta \in M^C \), there is no incentive to choose a report in the monitoring region because the assigned tariff will be the same as if no monitoring had occurred but the cost of monitoring will be incurred.

The potential for such an agreement to improve on the agreement with a tariff binding alone can be seen from Figure 3. For values of \( \theta \) sufficiently high, an increase in \( t \) would benefit both the importing country and the world as a whole. Therefore, we would expect to be able to raise world welfare by offering the possibility of escape from the binding to a higher tariff for high realizations of \( \theta \) if \( c \) is not too large.

In order to allow for this possibility, we will examine “cap and escape” agreements. A cap and escape agreement is one in which the monitoring region takes the form of an interval of the highest realizations of \( \theta \), \( M = [\theta^M, \bar{\theta}] \). These agreements are of interest because they
have features of the safeguards agreement in the WTO, which allows countries to raise their tariffs in the event that certain conditions are met.

## 4.1 Optimal Cap-and-Escape Agreements

A cap and escape agreement can be characterized by a tariff binding, $t^B$, a threshold value, $\theta^M$, for the monitoring region, $M = [\theta^M, \bar{\theta}]$, and a tariff schedule for the monitoring region, $t^M(\theta)$. We begin our analysis by establishing the following Lemma, which characterizes the optimal escape rule $\{\theta^M, t^M(\theta)\}$ given $t^B$.

**Lemma 3** Suppose that for a given $t^B$, there exists a $\hat{\theta} < \bar{\theta}$ such that $W(t^E(\hat{\theta}), \hat{\theta}) - c = W(t^B, \hat{\theta})$. Then given $t^B$, the optimal escape rule is given by $t^M(\theta) = t^E(\theta)$ for $\theta \in M = [\hat{\theta}, \bar{\theta}]$.

**Proof.** For $\theta \leq t^{N-1}(t^B)$, the only incentive compatible tariff schedule is given by $t^N(\theta)$ and, hence, monitoring in this region is not optimal. For $\theta > t^{N-1}(t^B)$, monitoring will be incentive compatible iff $V(t^M(\theta), \theta) - V(t^B, \theta) \geq c$. Since $W(t^M(\theta), \theta) - W(t^B, \theta) = (V(t^M(\theta), \theta) - V(t^B, \theta)) + (V^*(t^M(\theta)) - V^*(t^B))$ and $V^*(t)$ is decreasing in $t$, any agreement with $t > t^B$ that raises world welfare is also incentive compatible. Therefore, the monitoring region should consist of all $\theta$ such that world welfare can be raised by monitoring. World welfare cannot be improved by monitoring for $\theta \in [t^{E-1}(t^B), \hat{\theta}]$, because $\frac{\partial W(t^E(\theta), \theta) - W(t^B, \theta)}{\partial \theta} = \pi(t^E(\theta)) - \pi(t^B) > 0$ for $t^E(\theta) > t^B$. For $\theta \geq \hat{\theta}$, world welfare is maximized at $t^E(\theta)$. Therefore, since $t^E(\theta)$ is also incentive compatible for $\theta \geq \hat{\theta}$, the optimal escape rule is $t^M(\theta) = t^E(\theta)$ for $\theta \geq \hat{\theta}$.

Lemma 3 shows that monitoring occurs less frequently than would be desired by the importing country, because $\theta^M$ exceeds the value of $\theta$ at which the importing country would prefer to incur monitoring costs in order to obtain the efficient tariff. This is because the importing country’s tariff imposes negative externalities on the rest of the world and, hence, the threshold level of $\theta$ for monitoring to raise world welfare is above the threshold for the importer to gain from monitoring. In particular we must have $\theta^B < t^{E-1}(t^B) < \theta^M$. As a result, the trade agreement will specify an efficient tariff in the monitoring region because the incentive constraint on monitoring is not binding. Note that this result would continue to hold if part of the monitoring costs were paid by the rest of the world, since this would

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16 This result is reminiscent of the ‘serious’ injury condition under the WTO agreements on safeguards and antidumping, which precludes the use of contingent protection measures in cases where the magnitude of alleged injury to domestic industries is not sufficiently great.
only have the effect of relaxing the importer’s reporting constraint, which does not bind in
the optimal contract.

As a result of Lemma 3, the boundary of the monitoring region is the solution to

\[ W(t^E(\theta^M), \theta^M) - W(t^B, \theta^M) - c = 0. \]  (17)

Totally differentiating this condition and rearranging yields

\[ \frac{\partial \theta^M}{\partial t^B} = \frac{W_t(t^B, \theta^M)}{\pi'(t^E(\theta^M)) - \pi(t^B)} > 0, \]

and

\[ \frac{\partial \theta^M}{\partial c} = \frac{-1}{\pi'(t^E(\theta^M)) - \pi(t^B)} < 0, \]

for \( t^B < t^{pr} \). Therefore, a higher binding reduces the benefit of monitoring and thus
reduces the range of political parameters over which monitoring is optimal. Similarly,
higher costs of monitoring will also reduce the range of realizations for which monitoring
is chosen.

Using (17), we can express the problem for designing the optimal cap and escape agree-
ment as

\[
\max_{t^B} E[W] = \int_0^{\theta^B(t^B)} W(t^N(\theta), \theta) f(\theta) d\theta + \int_{\theta^B(t^B)}^{\theta^M(t^B)} W(t^B, \theta) f(\theta) d\theta \\
+ \int_{\theta^M(t^B)}^{\bar{\theta}} W(t^E(\theta), \theta) - c) f(\theta) d\theta. \]  (18)

The necessary condition for optimal choice of binding will be

\[
\pi_t(t^B) (F(\theta^M(t^B)) - F(\theta^B(t^B))) \left[ \frac{W_t(t^B, 0)}{\pi_t(t^B)} + E[\theta | \theta^M(t^B) > \theta] > \theta^B(t^B)] \right] = 0. \]  (19)

For cases in which monitoring takes place with \( c > 0 \), we have \( F(\theta^M(t^B)) > F(\theta^B(t^B)) \)
and the necessary condition can only be satisfied if the bracketed expression equals 0.
Comparing (11) and (19), it can be seen that the effect of introducing monitoring equals 0.
Comparing (11) and (19), it can be seen that the effect of introducing monitoring equals 0.
Comparing (11) and (19), it can be seen that the effect of introducing monitoring equals 0.
binding for a smaller set of states.

In order for a solution to (19) to be a local maximum, it must also satisfy

$$\frac{2}{(1 + t^B)^2} > \partial E[\theta|\theta^M > \theta > \theta^B]) \frac{\partial \theta^B}{\partial t^B} + \frac{\partial E[\theta|\theta^M > \theta > \theta^B]) \frac{\partial \theta^M}{\partial t^B}. \quad (20)$$

This condition ensures that the cost of raising $t^B$ increases faster than its benefit at the interior solution. It is instructional to compare condition (20) with the SOC for the case without monitoring. These conditions are similar, except that in the case with monitoring an increase in $t^B$ raises both the upper and lower thresholds of the region where the tariff is at the binding, while in the case without monitoring an increase in $t^B$ only raises the lower threshold. Both of these effects increase the marginal benefit of raising the binding and, thus, make the conditions for an interior maximum more stringent than in the case without monitoring.

The necessary conditions do not yield closed form solutions for $t^B$ when there is monitoring, so we begin with a very general result showing that the introduction of monitoring will result in a reduction in the tariff binding.

**Proposition 3** If $\bar{\theta} < \theta^{\text{max}}$, there will exist a tariff binding $t^{B,M} < t^{pro}$ that maximizes expected world welfare with monitoring. If $\theta^M(t^{B,M}, c) < \bar{\theta}$, then $t^{B,M}$ is less than the binding that maximizes world welfare without monitoring.

Proposition 3 shows that the introduction of monitoring will reduce the level of optimal tariff binding. As a result, in cases where the optimal agreement without monitoring involved the use of tariff overhang, the introduction of monitoring will reduce the expected magnitude of tariff overhang.

### 4.2 Overhang vs. Escape Clause as Means of Flexibility

Overhang and escape clause both provide governments with flexibility to respond to political shocks. It was shown in Proposition 3 that although the introduction of monitoring increases flexibility by means of providing an escape, it will reduce the amount of flexibility that is provided through binding overhang. An interesting question arises: does binding overhang occur in an optimal cap-and-escape agreement? In other words, does the introduction of monitoring reduce the binding to a level that completely eliminates the likelihood of overhang?
To analyze this question, we focus on the case where \( \theta \) has a uniform distribution, which yields \( E(\theta|\theta^M > \theta > \theta^B) = \frac{\theta^B + \theta^M}{2} \). Using the definition of \( \theta^B(t^B) \) given by \( 10 \) we can solve for the locus of values of \( t^B \) and \( \theta^M \) satisfying \( 19 \) to be

\[
t^BM(\theta^M) = \max \left[ \frac{\theta^M - \lambda \theta^{\max}}{2 - \theta^M - 4\lambda/(1 + \beta)}, \frac{\theta^M + \theta}{4 - \theta^M - \theta} \right].
\] (21)

The first element in the bracket above is the value of \( t^BM(\theta^M) \) at an interior solution where \( t^BM(\theta^M) > t^N(\theta) \). The second element in the bracket is the value of \( t^BM(\theta^M) \) at a corner solution, which involves zero overhang. For \( \theta^M = \bar{\theta} \), \( 21 \) corresponds to the solution for bindings without monitoring obtained in Proposition 1. For \( \theta^M < \bar{\theta} \), the necessary condition will involve monitoring and a binding that is lower than the level without monitoring. In order for this solution to be a local maximum it must also satisfy \( 20 \), which requires that

\[
\frac{2}{(1 + t^B)^2} > \frac{1}{2} \left( \frac{\partial \theta^B}{\partial t^B} + \frac{\partial \theta^M}{\partial t^B} \right)
\] (22)

This condition is more likely to fail when the lower and upper boundaries of the overhang regions, \( \theta^B \) and \( \theta^M \), are more responsive to changes in the tariff binding. One factor that reduces the responsiveness of the lower boundary of the overhang region is the slope of the Nash tariff with respect to the political shock, \( \frac{\partial \theta^N}{\partial \theta^M} \). When the Nash tariff is more responsive to the political shock, \( \frac{\partial \theta^B}{\partial \theta^M} \) is smaller, which reduces \( \frac{\partial \theta^BM(\theta^M)}{\partial \theta^M} \) and makes it more likely the second order condition is satisfied. The following Lemma provides a sufficient condition for \( 20 \) to fail to be satisfied for a given value of \( \theta \).

**Lemma 4** Suppose that \( \theta \) has a uniform distribution with \( \underline{\theta} < \bar{\theta} < \theta^{\max} \) and the necessary condition is satisfied with \( \underline{\theta} < \theta^B(t^M) < \theta^M(t^B) < \bar{\theta} \). This solution will fail to satisfy the second order condition if \( \beta < \tilde{\beta}(\theta^M) \).

The preferences of the importing country are becoming more aligned with those of the world at \( \theta^M \) if \( \beta < \tilde{\beta}(\theta^M) \), which means that the home country's Nash tariff schedule is flatter than that of the world. Lemma 1 establishes that this condition is sufficient to ensure that the second order condition will fail at an interior solution. This is consistent with the observation above that a flatter Nash tariff schedule makes it more likely that \( 22 \) will fail. An implication of this Lemma is that

**Proposition 4** If preferences are globally convergent (i.e., if \( \beta < \tilde{\beta}(0) \equiv 1 + 2\sqrt{1 + \lambda} \))
then escape and overhang do not coexist under an optimal cap-and-escape agreement.

In other words, for a given country size, if the comparative advantage parameter is not too large, flexibility is provided either through overhang or an escape clause, but not both. That is because according to Lemma 4, an interior solution with \( \bar{\theta} < \theta^B(t^M) < \theta^M(t^B) < \bar{\theta} \) do not satisfy the SOC. Note that this result is also consistent with Proposition 1, since it suggests that reducing convergence of preferences makes overhang less valuable as a flexibility mechanism.

### 4.3 Numerical Examples

This Proposition indicates that \( \beta > \tilde{\beta}(\theta^M) \) is necessary for there to be an interior solution that is a local maximum. However, it does not guarantee that there exist parameterizations for which a trade agreement with both overhang and monitoring is a global maximum. In this section we provide a numerical example to show that both overhang and monitoring may be part of an efficient agreement when \( \beta > \tilde{\beta}(\theta^M) \). This example also provides some insights on how the use of monitoring and overhang varies with country size and the level of monitoring costs.

We consider an example with \( \theta \) having a uniform distribution on \([0, .75]\). Since \( \tilde{\beta}(\theta) \) is increasing in \( \theta \) and \( \lambda \), the preferences of the importing country be locally divergent on \([0, .75]\) for all \( \lambda \in (0, 1) \) if \( \beta > 6.73 \). The optimal trade agreement was obtained by doing a grid search over tariff bindings, given country size and the level of monitoring costs, to find the cap and escape agreement \( \{t^B, \theta^M(t^B, c)\} \) that yields maximum expected world welfare. The results shown in Figures 4 and 5 are based on \( \beta = 20 \). Using the results of Proposition 1 for the case where monitoring is not allowed, this parameterization yields an agreement with no overhang and a bound tariff of \( t^B = .23 \) for \( \lambda \geq \tilde{\lambda} = .26 \). For \( \lambda < \tilde{\lambda} \), the agreement without monitoring will involve overhang and will have a binding that is decreasing in \( \lambda \) and approaches a maximum of .6 as \( \lambda \to 0 \).

Figure 4 shows the relationship the level of the tariff binding in the optimal cap and escape agreement for relatively small countries, \( \lambda \in \{0.1, 0.15, 0.2\} \), as the level of monitoring costs varies. The horizontal segment in each schedule corresponds to the tariff binding when monitoring costs are sufficiently high that the monitoring region is empty, and shows that the binding is decreasing in country size in the absence of monitoring as established in Proposition 1. The steeply increasing segments for each relationship in Figure 4 correspond to the values of regions where the trade agreement uses both overhang and
monitoring. The introduction of monitoring results in a sharp decline in the binding, as the use of monitoring is substituted for tariff overhang as a source of flexibility. Note also that the threshold level of monitoring costs at which monitoring is introduced into the optimal contract increases more than proportionally with the size of the country. The threshold monitoring cost for $\lambda = 0.2$ is approximately 8 times that for $\lambda = 0.1$. This suggests that overhang is relatively more useful as a means of introducing flexibility into a contract for countries that are small.

The slowly increasing segments in each locus in Figure 4 correspond to the region of monitoring costs where there is no overhang in the trade agreement. Increases in monitoring costs result in higher tariff bindings, but the effect is smaller than in the region where there is overhang. Note that for all country sizes illustrated in Figure 4, a larger country size is associated with lower bindings both in agreements with and without monitoring. Overall, these results indicate agreements with overhang and no monitoring at high levels of $c$, agreements with both monitoring and and overhang at intermediate levels of $c$ and no overhang at low levels of $c$.

Figure 5 depicts the relationship between monitoring costs and bindings for larger country sizes, $\lambda \in \{0.22, 0.27, 0.32\}$. For $\lambda = 0.22 < \lambda$, the pattern is similar to that in Figure 4. For $\lambda > 0.26$, there is no tariff overhang in the agreement when monitoring is not
allowed and the binding is independent of country size as established in Proposition 1 (ii). As monitoring costs fall, the optimal agreement moves directly from an agreement with no overhang and no monitoring to one with no overhang and monitoring as monitoring costs fall. For countries in this size range, market power is sufficiently large that it is never optimal to have overhang as part of the trade agreement. The threshold level of monitoring costs at which monitoring is introduced into the agreement is also increasing in country size for the examples illustrated in Figure 5, although the change in the monitoring cost with respect to country size is smaller.

For $\beta < 1 + 2\sqrt{1 + \bar{\lambda}}$, there will be no interior solutions for any $(\lambda, c)$ pairs. In this case there will be two different types of paths for trade agreements in response to reductions in monitoring costs. For $\lambda < \bar{\lambda}$, the optimal agreement will switch from one with overhang and no monitoring to one with monitoring and no overhang as monitoring costs fall below the threshold level. These countries are sufficiently small that tariff overhang is used to provide flexibility when monitoring is not used. However, due to the local convergence in preferences between the importer and the world for these parameter values, the introduction of monitoring will completely eliminate the use of tariff overhang in the agreement. This will result in a discontinuity in the relationship between tariff bindings and monitoring.
costs at the point where the monitoring region is non-empty. This contrasts with the case in Figure [3] where the reduction in tariff bindings is more gradual over the region where monitoring and overhang coexist. For $\beta < 1 + 2\sqrt{1 + \lambda}$ and $\lambda > \tilde{\lambda}$, there will be a threshold level of costs such that the agreement has no monitoring or overhang above the threshold and monitoring without overhang below. This outcome is similar to that illustrated in Figure [5] for $\lambda = \{0.27, 0.32\}$, because these countries are sufficiently large that overhang is not used as part of an optimal trade agreement.

One of the concerns expressed about the WTO mechanisms has been that small and developing countries face a disadvantage in participating in WTO contingent protection mechanisms due to the large fixed cost element involved in participation. This point has been made in the context of dispute settlement (e.g. [Bown (2005)] and [Shaffer (2003)]). Since one of the costs of contingent protection mechanisms is the possibility that a dispute is initiated as a result of the action, our results have the potential to provide some insight on this issue. Our simulations suggest that the threshold level of monitoring cost at which monitoring will be used is increasing in country size for small and medium sized countries.\footnote{This result may be reversed for very large values of $\lambda$, since in this case the world efficiency gains from trade liberalization are relatively small.} In particular, the threshold may increase more than proportionally with country size. However, our analysis also shows that small countries have an advantage in the use of tariff overhang, which serves as an alternative flexibility mechanism to contingent protection measures.

5 Conclusions

Our analysis has shown how tariff bindings and contingent protection provide alternative means of introducing flexibility into trade agreements. Tariff overhang allows countries to make unilateral policy changes in response to political shocks, but has the disadvantage that the importing country will always choose a tariff that is higher than the first best tariff. As a result, tariff overhang will be used most extensively for countries that have relatively little market power. In contrast, contingent protection allows the imposition of tariffs that are efficient from a world point of view. However, it has the disadvantage of requiring the use of resources to verify the state.

Our results indicates that allowing contingent protection will result in a substitution of monitoring for tariff overhang if monitoring costs are sufficiently low. In particular, we
showed that agreements will never involve both the use of contingent protection and tariff overhang if the preferences of the importer and the world are everywhere locally convergent. However, monitoring and overhang may coexist if preferences of the importer and the world are locally divergent. Our simulations also indicated that contingent has the lowest value for relatively small countries, since the use of tariff overhang will be a relatively more efficient mechanism for providing flexibility when terms of trade externalities are small.

Our analysis has highlighted the role of both market power and the convergence of preferences as determining the relative importance of tariff overhang and escape clauses in providing flexibility. Our analysis is the first to emphasize the role of preference convergence, which refers to whether the protectionist bias of importing countries increases or decreases as the magnitude of political shocks increase. Models which rely on the terms of trade externalities as the source of externalities in trade agreements will necessarily result in the convergence of preferences if political shocks are sufficiently large that they result in the imposition of prohibitive tariffs. However, our analysis shows that divergences of preferences can occur for smaller magnitudes of the political shocks and may play an important role in determining the value of tariff overhang. The role of preference divergence in other types of political economy models remains an area for future work.

References


A Appendix

**Proof of Lemma 1.** Differentiation of (4) yields

\[
\frac{\partial t^N}{\partial \theta} = \frac{2(1 + \lambda)(1 + \beta)^2}{\Lambda} > 0 \quad \frac{\partial t^N}{\partial \beta} = \frac{8\lambda(1 + \lambda)}{\Lambda} > 0 \quad \text{for } \theta < \theta^{\text{max}}
\]

where \(\Lambda = ((\beta + 1)(2 - \theta) + 4\lambda)^2\). Part (iii) follows from \(\frac{\partial t^N}{\partial \theta} / \frac{\partial t^N}{\partial \lambda} = \frac{4\lambda(1 + \lambda)}{(1 + \beta)^2(\theta^{\text{max}} - \theta)}\), which is increasing in \(\theta\) for \(\theta < \theta^{\text{max}}\).

**Proof of Lemma 4.** (i) Differentiation of (4) and (6) yields

\[
\Delta'(\theta) = \frac{2\lambda \left[ \beta^2 (2 - \theta)^2 - 2\beta (4 - \theta^2) - 4 (3 + 4\lambda - \theta) + \theta^2 \right]}{(2 - \theta)^2 ((\beta + 1)(2 - \theta) + 4\lambda)^2}
\]

The sign of this expression is determined by the sign of the bracketed expression in the numerator, which will be increasing in \(\beta\) because \(2(2 - \theta) [2(\beta - 1) - (\beta + 1)\theta] > 0\) for \(\theta < \theta^{\text{max}}\). The bracketed expression will equal 0 at \(\beta = \frac{2 + \theta + 4\sqrt{1 + \lambda}}{2 - \theta}\).

(ii) Let \(d\lambda = -kd\beta < 0\), where \(k = \left(\int_{\theta_0}^{\overline{\theta}} t^N_{\beta}(\theta) f(\theta)d\theta\right) / \left(\int_{\theta_0}^{\overline{\theta}} t^N_{\lambda}(\theta) f(\theta)d\theta\right) > 0\). Since \(t^N_{\beta}(\theta)/t^N_{\lambda}(\theta)\) is continuous and increasing in \(\theta\) by Lemma 1, \(t^N_{\beta}(\theta_0)/t^N_{\lambda}(\theta_0) < k < t^N_{\beta}(\overline{\theta})/t^N_{\lambda}(\overline{\theta})\) and there will exist some \(\theta_1 \in (\theta_0, \overline{\theta})\) such that \(k = t^N_{\beta}(\theta)/t^N_{\lambda}(\theta)\). We then have \(dt^N(\theta) = \left(t^N_{\beta}(\theta) - kt^N_{\lambda}(\theta)\right) d\beta > (<) 0\) for \(\theta < (>) \theta_1\).

**Proof of Proposition 1.** Define \(J(t) = E(\theta|\theta \geq \theta^B(t)) - \frac{2t}{1 + t}\), where \(\theta^B(t) = \max\{\frac{2(1 + \beta + 4\lambda(t - \theta^B(t)))}{(1 + t)(1 + \beta)}\}\), which can be written as

\[
J(t) = \begin{cases} 
\frac{\overline{\theta} - \gamma}{1 + \gamma} - \frac{2t}{1 + t}, & \text{if } t \in [0, t^N(\theta)]. \\
\frac{\overline{\theta} - \lambda t^{\text{max}} - t(2 - \overline{\theta} - \frac{4\lambda}{1 + \beta})}{(1 + t)(1 + \gamma)}, & \text{if } t \in [t^N(\theta), t^N(\overline{\theta})].
\end{cases}
\]
The necessary condition for optimal choice of binding, \( J(t) = 0 \), will be satisfied if either \( J(t) = 0 \) or \( t^B = t^N(\bar{\theta}) \). If the solution to (11) also satisfies \( 1 - F(\theta^B(t)), J'(t) - f(\theta^B(t)) J(t) \frac{\partial \theta^B}{\partial \theta} < 0 \), then it will be a local maximum. Since \( J(t^N(\bar{\theta})) = \frac{\lambda(\bar{\theta} - \theta_{\text{max}})}{(1+\lambda)} < 0 \) for \( \bar{\theta} < \theta_{\text{max}} \), the solution with \( t^B = t^N(\bar{\theta}) \) will be a local minimum for \( \bar{\theta} < \theta_{\text{max}} \). A solution with \( J(t) = 0 \) will be a local maximum if \( J'(t) < 0 \). These observations, combined with the following Lemma 5, establish Proposition 1.

**Lemma 5** \( J(t) \) is a continuous on \([0, t^N(\bar{\theta})]\), with \( J(0) > 0 \) and \( J(t^N(\bar{\theta})) < 0 \) for \( \bar{\theta} < \theta_{\text{max}} \).

(a) If \( \gamma \lambda < 1 \), then \( J'(t) < 0 \) and there exists a unique \( t^B \in (0, t^N(\bar{\theta})) \) that maximizes expected welfare. If \( \lambda \geq \tilde{\lambda} = \frac{\bar{\theta} - \theta}{(1+\gamma)\theta_{\text{max}} - 2\gamma\bar{\theta}} \), then \( t^B = \frac{E(\theta)}{2 - E(\bar{\theta})} \leq t^N(\theta, \lambda) \). If \( \lambda < \tilde{\lambda} \), then \( t^B = \frac{\bar{\theta} - \gamma \theta_{\text{max}}}{2 - 4\lambda \gamma/(1+\beta)}(t^N(\theta, \lambda), t^N(\bar{\theta}, \lambda)) \).

(b) If \( \gamma \lambda \geq 1 \), then there exists a unique \( t^B = \frac{\bar{\theta} - \gamma \theta_{\text{max}}}{2 - 4\lambda \gamma/(1+\beta)} \in (0, t^N(\theta)) \) that maximizes expected welfare.

**Proof.** From (A.1), \( J(t) \) is continuous in \( t \) with \( J'(t) = -\frac{2}{(1+t)^2} \) for \( t < t^N(\bar{\theta}) \) and \( J'(t) = \frac{2(\gamma \lambda - 1)}{(1+t)^2(1+\gamma)} \) for \( t > t^N(\bar{\theta}) \).

(a) Since \( J(0) = E(\theta) > 0 \) and \( J(t^N(\bar{\theta})) < 0 \) as established above, there will exist a unique \( t^B \) such that \( J(t^B) = 0 \) if \( \gamma \lambda < 1 \). This solution will be a global maximum since \( J'(t^B) < 0 \). A corner binding with no overhang will exist if \( t^B = \frac{E(\theta)}{2 - E(\bar{\theta})} \leq t^N(\theta, \lambda) \), which is shown to hold for \( \lambda \geq \tilde{\lambda} \) using (4). For \( \lambda < \tilde{\lambda} \), the optimal binding is obtained by solving \( J'(t^B) = 0 \).

(b) If \( \gamma \lambda > 1 \), \( J'(t) > 0 \) for \( t \in (t^N(\theta), t^N(\bar{\theta})) \) and there cannot exist a local maximum on this interval. This yields two possibilities: a corner solution with no overhang or a corner solution with an unbound tariff (i.e. \( t^B \geq t^N(\bar{\theta}) \)). Since \( \tilde{\lambda} < \frac{1}{\gamma} \) when \( \bar{\theta} < \theta_{\text{max}} \), \( \gamma \lambda > 1 \) implies \( \lambda > \tilde{\lambda} \) and there will exist a local maximum with no overhang, \( t^B \in (0, t^N(\theta)) \), by the arguments in (a). To show that there cannot be an optimum at a corner solution with an unbound tariff, we show that \( EW[t^B] \) is decreasing on \((t^N(\theta), t^N(\bar{\theta}))\). Since \( J'(t^B) = \text{sign} J(t) \), it is sufficient to show that \( J(t) < 0 \) on that interval. We have established that \( J(t) \) is continuous with \( J(t^N(\theta)) < 0 \), \( J(t^N(\bar{\theta})) < 0 \), and \( J'(t) > 0 \) for \( t \in (t^N(\theta), t^N(\bar{\theta})) \). Therefore we must have \( J(t) < 0 \) on the interval.

**Proof of Proposition 2.** Recall that the first-order condition for optimal tariff binding is given by \( \frac{2\theta^B}{1+\sigma} = E[\theta|\theta > \theta^B(t^B)] \). The left-hand side of this condition is unaffected by
changes in \( \lambda \) and \( \beta \). Therefore, it is sufficient to show that as a result of this perturbation in \( \beta \) and \( \lambda \), \( \theta^B(t^B) \) increases.

Now note that since \( \Delta(\theta) = t^N(\theta) - t^E(\theta) \), and \( t^E(\theta) \) is independent of \( \lambda \) and \( \beta \), an increase in \( \beta \) and reduction in \( \lambda \) that keeps \( \int_{\theta^B}^{\theta} t^N(\theta) f(\theta) d\theta \) constant will also keep \( \int_{\theta^B}^{\theta} \Delta(\theta) f(\theta) d\theta \) constant. Therefore, according to Lemma 2(ii), \( t^N(\theta^B) \) decreases as a result of this perturbation in \( \beta \) and \( \lambda \). But since \( \theta^B(t^B) = (t^N)^{-1}(t^B) \), this perturbation in \( \beta \) and \( \lambda \) results in an increase in \( \theta^B(t^B) \). QED. ■

**Proof of Proposition 3.** Let \( H(t) = E[\theta^M(t^B(t)) > \theta > \theta^B(t)] - \frac{2t}{1+t} \), where \( H(t) \leq J(t) \). \( H(t) \) will be continuous on \( [0, t^{pro}] \), with \( H(0) > 0 \) and \( H(t^{pro}) < J(t^{pro}) \). Therefore, there will exist a solution \( t^{BM} \in (0, t^{pro}) \) satisfying \( H(t^{BM}) = 0 \). Lemma 5 established that for \( \bar{\theta} < \theta_{\text{max}} \), there will be a unique value \( t^B \) satisfying \( J(t^B) = 0 \). In addition, \( J(t^B) < 0 \) for \( t > t^B \), which ensures that \( t^{BM} < t^B \). The inequality will be strict if \( \theta^M(t^B) < \bar{\theta} \). ■

**Proof of Lemma 4.** In the case of a uniform distribution, we have \( \frac{\partial E[\theta^M > \theta > \theta^B]}{\partial \theta^M} = \frac{1}{2} \). At an interior solution, \( \frac{\partial \theta^B}{\partial t^{BM}} = \frac{2(1+\lambda)}{(1+t^{BM})^2} \) and the second order condition for a maximum simplifies to

\[
\frac{1-\lambda}{(1+t^{BM})^2} > \frac{1}{2} \frac{\partial \theta^M(t^{BM}, c)}{\partial t}
\]

(23)

Differentiating the condition for determining the boundary of the monitoring region yields

\[
\frac{\partial \theta^M}{\partial t} = \frac{2B(\theta^M)^2}{[1+\beta(1-\lambda)+\lambda(1+2t)][(4-\theta^M)(\beta+1)(1-\lambda)+8\lambda+t(B(\theta^M)+4\lambda)]}
\]

(24)

where \( B(\theta^M) \equiv (\beta+1)(2-\theta^M)(1-\lambda)+4\lambda \).

If the necessary condition is satisfied at a given value \( \theta^M \), the binding must satisfy \( \frac{2t^{BM}}{1+t^{BM}} = \frac{\theta^B(t^{BM})+\theta^M}{2} \). Solving the necessary condition yields

\[
t^{BM}(\theta^M) = \frac{\theta^M(1+\beta) - 2\lambda(\beta-1)}{(2-\theta^M)(1+\beta) - 4\lambda}
\]

(25)

Substituting (25) and (17) into (23) yields the requirement for an interior solution to be a
local maximum,

\[
\frac{((\beta + 1) (2 - \theta^M) - 4\lambda)^2}{2 (\beta + 1)^2 (1 - \lambda)} > \frac{((\beta + 1) (2 - \theta^M) - 4\lambda)^2 B(\theta^M)^2}{2 (\beta + 1)^3 (1 - \lambda)^2 (2 - \theta^M) A(\theta^M)}
\]  \hspace{1cm} (26)

where \(A(\theta) \equiv (\beta + 1) (2 - \theta^M) (2 - \lambda) + 4\lambda\). This condition will be satisfied if

\[
Z(\theta^M, \beta) = (\beta + 1) (1 - \lambda) (2 - \theta^M) A(\theta^M) - 2B(\theta^M)^2 > 0
\]  \hspace{1cm} (A.4)

It follows from (A.4) that \(Z\) is continuous in \(\beta\), with \(\frac{\partial^2 Z}{\partial \beta^2} = 2\lambda (1 - \lambda) (2 - \theta)^2 > 0\), \(Z(\theta^M, 1) = -4\lambda (8 - 2 (1 - \lambda) \theta^M (2 + \theta^M)) < 0\) and \(Z(\theta, \bar{\beta}) = -16(1 + \lambda^2 + (1 - \lambda) \sqrt{1 + \lambda}) < 0\). The convexity of \(Z\) in \(\beta\) thus ensures that \(Z(\theta^M, \beta) < 0\) for all \(\beta \in (1, \bar{\beta}]\). Therefore, there can be no interior optimum for \(\beta < \bar{\beta}\). \(\blacksquare\)