Third-Party-Assisted Renegotiation of Trade Agreements∗

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Abstract

I study the design and implementation of trade agreements under asymmetric information with the help of an impartial third party. The Dispute Settlement Body (DSB) of the World Trade Organization is modeled as an impartial entity that provides ‘recommendations’ for the resolution of disputes based on its imperfect observation of the state of the world. A model of post-ruling bargaining is proposed in which the parties regard the DSB’s recommendations as a reference point. The recommendations of the DSB reduce the cost of providing incentive for revelation of private information by framing renegotiations in favor of the party who is more likely to have a legitimate claim. Moreover, pre-trial bargaining is modeled as a signaling game in the shadow of litigation. The model has rich predictions regarding generation of disputes, selection of cases for litigation, the ruling pattern of the DSB, compliance and retaliations. In particular, noncompliance with the DSB rulings

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emerges as an outcome on the equilibrium path. Moreover, the model predicts that the rulings of the DSB are always at least partly against the defending party, which may explain the observed pro-complainant bias in the DSB rulings.

1 Introduction

The value of a trade agreement depends crucially on how it is implemented. In practice, deviations from the terms of the agreement may not be detected or punished successfully, which undermines the benefits of the agreement. For example, under the GATT “rules departures (breaches) have in some cases become so frequent and so tolerated that the rules are now simply traps for the unwary, inexpert, or naive.” (Jackson 1978, p. 748) A general consensus about the need for a more effective implementation of trade agreements under the GATT shifted the focus of trade negotiations from the exchange of market access towards the design of a system of rules and procedures for enforcement and renegotiation of trade agreements. As a result, the World Trade Organization was established in 1995 with various institutional measures to facilitate effective implementation of trade agreements.

The main institutional achievement of the WTO was an enhanced dispute settlement process. The economic literature in the past decade has improved our understanding about the role of the WTO Dispute Settlement Body (Maggi 1999, Beshkar 2007, Maggi and Staiger 2008), and the design of a system of breach remedies (Bagwell and Staiger 1999, Schwartz and Sykes 2002, Beshkar 2010). However, in the words of a prominent WTO scholar in 2009, “we are still far away from developing a comprehensive theory of disputes – there are no models predicting when disputes will occur in a setting like the WTO.”

One shortcoming of the existing models is that they mostly focus on the decision making of the DSB and ignore or oversimplify other stages of the process. For example, these papers avert the study of post-ruling negotiations by the assumption that the DSB’s rulings are binding. Nevertheless, an important feature of the WTO’s

\footnote{From Petros Mavroidis foreword to Schropp (2009).}
legal system is that the disputing parties are not bound to comply with the rulings of the DSB.\(^2\) For instance, in the Hormones dispute between the European Communities (as defendant) and the United States and Canada (as complainants), the Dispute Panel found that the EC ban on imports of meat and meat products from cattle treated with some specific hormones for growth promotion purposes was inconsistent with EC’s obligations under the Agreement on Sanitary and Phytosanitary Measures (SPS Agreement). Nevertheless, the European Communities declined to comply with the DSB’s ruling and continued its ban on such imports for several years (WTO c).\(^3\) A theoretical prediction of this paper, which distinguishes it from the recent literature, is that noncompliance with the DSB rulings emerges as an equilibrium outcome.

Pre-trial settlement negotiation is another key feature of the WTO dispute settlement process that needs to be incorporated into a comprehensive study of this system. By ratifying the Dispute Settlement Understanding (DSU), WTO members have agreed to engage in bilateral “consultations” prior to the establishment of a dispute panel in order to find a mutually accepted solution. Some 60 percent of the initiated disputes are settled during the consultation stage and never reach the formal trial process. The cases that do reach the panel stage are unlikely to be randomly chosen from the set of all disputes and, as a result, any interpretation of the DSB rulings and the degree of compliance must take this selection process into consideration.\(^4\)

\(^2\) According to the WTO Dispute Settlement Understanding, “recommendations or rulings made by the DSB shall be aimed at achieving a satisfactory settlement of the matter...”, and noncompliance only leads to the re-establishment of the balance of economic concessions between the parties.

\(^3\) In the Hormones dispute, EC’s noncompliance with the DSB’s ruling prompted a bargaining process between the disputing parties to determine the extent of sanctions to be imposed on EC by the complaining countries. This dispute was finally concluded after the United States and Canada were authorized to retaliate against EC by suspending their concessions to EC to an amount equal to US$116.8 million and CDN$11.3 million per year, respectively (WTO c). Another example of post-ruling negotiation is provided by the Canada-Dairy dispute, in which United States and New Zealand accused Canada of taking illegal measures regarding the importation of milk and the exportation of dairy products. In this case the DSB’s ruling against Canada was followed by a long period of negotiations between disputing parties. After more than three years of negotiations, the parties achieved a mutually accepted solution that was different from the original ruling of the DSB (WTO a).

\(^4\) According to the WTO website (checked January 2010), so far 402 formal disputes have been initiated under the auspices of the DSU from which more than 40 percent resulted in a panel
The objective of this paper is to offer a unified framework to study important stages of the dispute settlement process, namely, dispute generation, selection of cases for litigation, the DSB’s decision making, compliance, and retaliation. I take the view that the dispute settlement process is effectively a “renegotiation” process in which governments try to adjust their trade policies to reflect changes in political and economic circumstances. I assume that governments have private information about the fluctuating political-economy conditions in their respective countries. A disagreement naturally arises if some contingencies are not symmetrically observable to all the trading partners. Allowing for renegotiation of the agreement is then interpreted as a means to settle potential disputes through an ex-post bargaining process.

The DSB is modeled as an impartial entity that provides ‘recommendations’ for the resolution of disputes based on its imperfect observation of the state of the world. The recommendations of the DSB set a reference point to calculate the size of violation that the defending party’s proposed policy entails. The size of violation then determines the size of retaliatory measures to be imposed by the complaining party. The DSB can use its imperfect but informative signal about the state of the world to set a reference point that favors the party who is more likely to have a legitimate claim. Such a ruling strategy by the DSB increases the efficiency of the bargaining outcome by reducing the cost of providing incentive for revelation of private information.

This interpretation of the DSB fits quite well with the role that has been assigned to the dispute panels in the WTO. Article 11 of DSU gives the dispute panels the authority to make “objective assessment of the facts” of the dispute case concerned and to make “recommendations” to help the disputing parties to develop a mutually satisfactory solution (WTO b). This implies that the rulings of the DSB are not binding in the sense that a convicted party can decline to comply with the rulings. The rulings of the DSB, however, affects the prospect of renegotiations by setting a reference point that will be used to determine the size of retaliation in case of report. For statistical description and discussions about the level of utilization of the WTO dispute settlement process see Horn and Mavroidis (2006), Bown (2005, 2009), and Beshkar (2008).
non-compliance.

The WTO is viewed as a rules-based system in which trading partners agree on a set of initial tariffs and a set of renegotiation rules to deal with potential disputes. A rules-based renegotiation process can serve at least two purposes. First, a shift from a power-based system to a rules-based system may encourage developing countries to engage more actively in multilateral trade liberalization as their worries about handling future conflicts with big powers would be mitigated.

The second benefit of a rules-based system, which is highlighted in this paper, is that in absence of a zero-sum transfer mechanism (such as cash), unrestricted bargaining can lead to inefficient outcomes. For example, as noted by Bagwell 2008, in order to leave the exporting country in as good a position as in absence of a safeguard measure, disproportionate retaliations must be authorized. Essentially, when transfers are costly the joint welfare of the governments is maximized if no compensation is transferred at all. Therefore, a second purpose of a rules-based system is to limit retaliations to a minimum level that is just enough to induce governments to reveal their private information about the state of the world truthfully.

I follow a well-known approach in the bargaining literature in modeling the post-ruling bargaining problem as an incentive-compatible direct revelation mechanism (for example, see Samuelson 1984). I then extend this model by considering pre-trial settlement bargaining between the parties. A signaling game is introduced in which the importing country proposes a trade policy and the exporting country decides whether to accommodate or to challenge this proposal in the court.

The law and economic literature has mostly emphasized the cost of litigation as the reason for seeking out-of-court settlement. However, in many WTO dispute cases, litigation costs seem to be small compared to the size of the stake at dispute. Therefore, litigation costs alone is unlikely to provide a satisfactory explanation for a relatively high settlement rate (around 50%) in the WTO. In order to explore other motivations for avoiding litigation, I make the aggressive assumption that litigation is free in the WTO.

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5 See Limão and Saggi (2008) for a discussion of why cash compensation is rarely used as a means of settling disputes among WTO members.
Incorporating pre-trial negotiations into a model of DSB enriches the results by shedding light on the process through which disputes are generated and selected for litigation. In particular, the model predicts that exporting countries tolerate relatively minor deviations from the tariff bindings and, thus, a dispute is generated only if a relatively large deviation is observed. Moreover, the model predicts that the governments may sometimes choose to pursue trade policy adjustments that are based on purely protectionist objectives. Finally, only a fraction of the generated disputes are litigated and the rest are settled without escalating to the trial stage.

Because of its explicit treatment of dispute initiation and pre-trial settlement negotiations, the proposed model is particularly useful in guiding empirical investigations of the DSB. An important effect of pre-trial settlement is on the combination of cases that reach the trial stage. Therefore, the general direction of the DSB rulings may not be indicative of the system’s partiality.

This paper also provides a novel interpretation of the observed bias in the DSB rulings. As discussed by Sykes (2003), Grossman and Sykes (2007), and Colares (2009), in a strong majority of the cases the DSB rules at least partly against the defending party. This ruling pattern is shown to be part of the optimal design of the system. In particular, even if the DSB’s assessment of the disputed measure is in favor of the defending party, it is optimal for the DSB to authorize only a small deviation from the binding tariffs. This conservatism on behalf of the DSB in making pro-defendant ruling reflects the trade off between possibility of upholding a joint-welfare-reducing measure and authorizing efficiency-reducing retaliations.

The application of the model presented in this paper is not limited to the DSB. This paper shows that how an impartial third party with expertise in the subject of the dispute can improve the relationship between the trading partners. For example experts from World Health Organization and International Monetary Fund can play a useful role in the arbitration process in cases that are related to health and exchange rate policy, respectively.\footnote{I am grateful to Helen Milner for pointing this out to me.}

After reviewing the relevant literature in the next subsection, in Section 2 I introduce the economic and political environment in which trade agreements are
negotiated and implemented. In Section 3, I introduce a tariff bargaining game that is not assisted by a third party. In Section 4, I lay out a model of the DSB and post-ruling renegotiation of trade agreements, and characterize the optimal direct revelation mechanism. In Section 5, I offer an alternative institution for dispute settlement that resembles the actual DSB while generating the same outcome as the optimal direct mechanism. Finally, in Section 6 I study pre-trial settlement negotiations in the shadow of a formal trial by DSB. Section 7 concludes.

1.1 Literature review

Beshkar (2007) and Maggi and Staiger (2008) are among recent papers that provide formal models of the DSB. These models investigate alternative roles that an international tribunal like the DSB can play. Both papers view the DSB as an arbitrator that ‘imposes’ a settlement on the disputing parties with the objective to maximize the parties’ joint payoff. This is in contrast to the approach that I take here in which I view the DSB’s rulings as non-binding recommendations. It should be emphasized that this distinguishing feature of the current paper is very important in understanding the pattern of dispute settlement in the WTO.

In Beshkar (2007), as in the current paper, the governments may disagree on the nature of the prevailing contingency due to their asymmetric information of the state of the world. The DSB resolves the dispute by determining the trade policies to be taken by the parties as a function of the parties’ announcements and its privately-observed signal of the state of the world.

Maggi and Staiger (2008) consider a costly contracting setting that leads the governments to write incomplete contracts and provide the DSB with a mandate to fill the gaps when disputes arise. By writing an incomplete contract, the governments can avoid the cost of identifying all potential future contingencies. If countries find themselves in a contingency that is not specified by their ex ante contract, the DSB will fill the gap in the contract by determining a trade policy to be adopted by the parties. In making its policy determination, the DSB’s objective is to maximize the expected joint payoff of the governments, given its best guess about the governments’
preferences.

These models assume that the parties cannot seek a settlement that differs from the DSB’s determination even if they can mutually improve their welfare through ex post negotiations. Although these models provide important insights about the role of the DSB, they cannot explain some observed facts about the dispute settlement in the WTO, including the post-DSB negotiations between parties and noncompliance by some convicted parties, some examples of which were discussed above.

In a parallel research, Maggi and Staiger (2009) have developed a model of the DSB that allows for pre-trial and post-trial negotiations between the disputing parties. My paper is different from theirs in a number of important ways. First, they assume that the parties have symmetric information about the state of the world that is not verifiable to the court. Moreover, while I study continuous policies, Maggi and Staiger (2009) focus on disputes about trade policies that are lumpy in nature.

There is a large literature initiated by Myerson (1979, 1991) that explores the problem of binding arbitration, while in this paper my objective is to explain the role of institutions that offer non-binding arbitration. My model also differs from the strand of bargaining models that consider zero-sum bargaining situations. For example, Farber (1980) and Gibbons (1988) analyze a zero-sum bargaining situation in case of Final-Offer Arbitration (FOA). In a zero-sum bargaining situation, all arbitration outcomes are equally efficient and differ only in distributional consequences. This assumption is obviously not satisfied in a wide range of real world situations, including the case of tariff bargaining, which is the subject of study in this paper.

7FOA is a specific dispute settlement mechanism suggested by Stevens (1966). FOA is a form of binding arbitration under which each party submits a proposed award to the arbitrator, and the arbitrator chooses one award without modification. This approach gives each party an incentive to offer a reasonable proposal in the hope that it will be accepted by the arbitrator.

8The arbitrator’s objective in these models is to be “fair”, while the fair outcome is an uncertain variable regarding which parties and the arbitrator have asymmetric information.

9The focus of these models on fairness rather than efficiency may be justified using the argument of the Coase Theorem that parties can reach an efficient outcome through independent bargaining as long as parties have transferable utilities and the bargaining process is not hindered by transaction costs or other impediments. In the case of trade agreements, an important limitation in the bargaining process is the political cost of monetary transfers that leads governments to bargain almost exclusively over policy adjustments. In contrast to monetary transfer, policy adjustment is not a zero-sum transaction, which makes arbitration outcomes efficiency-relevant. In other words
2 Basic setup

The setup that I use here is based on a simple trade model frequently used in the literature (see, for example, Bagwell and Staiger 2005 and Beshkar 2007). Consider a pair of distinct goods $x$ and $y$ with demand functions in the home country (no *) and the foreign country (*) given by:

$$\begin{align*}
D_x(p_x) &= 1 - p_x, \quad D_y(p_y) = 1 - p_y, \\
D^*_x(p^*_x) &= 1 - p^*_x, \quad D^*_y(p^*_y) = 1 - p^*_y,
\end{align*}$$

(1)

where $p$ (with the appropriate index) represents the price of a good in a certain country. Specific import tariffs, $\tau$ and $\tau^*$, that are chosen by countries as the only trade policy instrument, create a gap between domestic and foreign prices. In particular, $p_x = p^*_x + \tau$ and $p_y = p^*_y - \tau^*$.

Both countries produce both goods using the following supply functions:

$$\begin{align*}
Q_x(p_x) &= p_x, \quad Q_y(p_y) = bp_y, \\
Q^*_x(p^*_x) &= bp^*_x, \quad Q^*_y(p^*_y) = p^*_y.
\end{align*}$$

(2)

Assuming $b > 1$, the home country will be a natural importer of $x$ and a natural exporter of $y$.

Under this model, the market-clearing price of $x$ ($y$) depends only on the home (foreign) tariff. Let $p_x(\tau)$ and $p_y(\tau^*)$ respectively denote the equilibrium prices of $x$ and $y$ in the home country. If import tariffs are non-prohibitve (i.e., if they are sufficiently small) trade occurs between the countries and the home consumers’ surplus from the consumption of $x$ and $y$ will be given by

$$\psi_x(\tau) \equiv \int_{p_x(\tau)}^{1} D_x(u) \, du, \quad \psi_y(\tau^*) \equiv \int_{p_y(\tau^*)}^{1} D_y(u) \, du.$$
Moreover, the home producers’ surplus from the sale of $x$ and $y$ will be given by

$$
\pi_x (\tau) \equiv \int_0^{p_x (\tau)} Q_x (u) \, du, \quad \pi_y (\tau^*) \equiv \int_0^{p_y (\tau^*)} Q_y (u) \, du.
$$

The government’s tariff revenue is given by

$$
T (\tau) \equiv \tau M_x (p_x (\tau)),
$$

where $M_x (p_x) \equiv D_x (p_x) - Q_x (p_x)$ is the import demand for good $x$ in the home country.

For reasons that will be clear later, I assume that there is another pair of goods, which are produced and consumed in an identical manner as above. This duplicate economy will make the modelling of the retaliation scheme very simple.

### 2.1 A Political Objective Function

Following Baldwin (1987), I assume that each government maximizes a weighted sum of its producers’ surplus, consumers’ surplus, and tariff revenues with a relatively higher weight on the surplus of its import-competing sector. The higher weight given to the welfare of a sector might be the result of political pressure, through lobbying for example, that a government faces. Denoting the political weight on the welfare of the import-competing sector in the home (foreign) country by $\theta$ ($\theta^*$), where $\theta, \theta^* \geq 1$, I assume that the home government’s welfare drawn from sector $x$ as a function of the home import tariff is given by

$$
u (\tau; \theta) \equiv \psi_x (\tau) + \theta \pi_x (\tau) + T (\tau),$$

and the home government’s welfare from sector $y$ as a function of the foreign import tariff is given by

$$
u (\tau^*) \equiv \psi_y (\tau^*) + \pi_y (\tau^*).$$
Therefore, \( W(\tau, \tau^*; \theta) = u(\tau; \theta) + v(\tau^*) \) represents the political welfare of the home government, which is additively separable in functions of the home and foreign tariffs. The foreign country’s welfare, \( W^*(\tau^*, \tau; \theta^*) \), can be defined in a similar fashion. It can be verified that for sufficiently low tariffs, the home government’s welfare is increasing in the home tariff and decreasing in the foreign tariff, i.e., \( \partial W(\tau, \tau^*; \theta) / \partial \tau > 0 \) and \( \partial W(\tau, \tau^*; \theta) / \partial \tau^* < 0 \).

2.2 Private Political Pressure Shocks

Recall that each country has two import-competing sectors. One of these sectors, called the political sector, is subject to random political shocks, i.e., the weight that the government gives to this sector may change over time. I assume that political pressure from the political sector can take two levels, i.e., low and high, denoted by \( \theta \) and \( \theta^* \) respectively. I further assume that the probability of high pressure from the political sector is given by \( \rho \), where, \( 0 < \rho < 1 \). The political parameter in the non-political import-competing sector is constant over time and for simplicity I assume it is equal to \( \theta \).

In what follows I assume that the governments use their retaliation rights in the non-political sector. This structure allows me to focus my analysis on the import tariffs of the home country in the political sector, and the retaliatory tariffs of the foreign country in the non-political sector. Due to symmetry, the foreign (home) country’s import (retaliatory) tariffs are identical to those of the home (foreign) country. Therefore, in what follows I restrict my attention to the home country’s import tariff in the political sector, denoted by \( \tau \), and the foreign country’s retaliatory tariffs in the non-political sector, denoted by \( r \).

3 Renegotiation under Asymmetric Information (No DSB)

To set a benchmark, I first consider tariff renegotiations between two countries with no access to a third party arbitrator such as DSB. The problem is to set a pair of
tariffs \((\tau, r)\), where \(\tau\) denotes the home country’s tariff in its political sector and \(r\) denotes the foreign country’s tariff in its non-political sector. Since the realization of the political sector’s pressure is private information of the domestic government, the problem of setting jointly optimal tariffs is best described as a bargaining problem under incomplete information.

I model this incomplete information bargaining problem as a direct revelation mechanism. Formally, before the realization of political pressure, parties agree on a mechanism that maximizes their expected joint welfare. At the beginning of a given period, political pressure is realized in the home country and is privately observed by the home government. The home government then announces its political pressure, and the mechanism determines the tariff rates of the home and the foreign countries.

The mechanism must be incentive compatible, meaning that the home government must have proper incentive to announce its political pressure truthfully. Denoting the home and foreign countries’ tariffs as a function of the home announcement by \(\tau (\theta)\) and \(r (\theta)\), respectively, the incentive compatibility constraints are given by

\[
W (\tau (\theta), r (\theta); \overline{\theta}) \geq W (\tau (\theta), r (\theta); \overline{\theta}),
\]

and

\[
W (\tau (\theta), r (\theta); \overline{\theta}) \geq W (\tau (\theta), r (\theta); \overline{\theta}).
\]

The first inequality above implies that the home government is better off by announcing a high political pressure, when it actually faces a high pressure. Similarly, the second inequality ensures the home government’s truthfulness at the time of a low political pressure.

The expected joint welfare of the governments is given by

\[
\rho [W (\tau (\theta), r (\theta); \overline{\theta}) + W^* (r (\theta), \tau (\theta); \overline{\theta})] + (1 - \rho) [W (\tau (\theta), r (\theta); \overline{\theta}) + W^* (r (\theta), \tau (\theta); \overline{\theta})]
\]

The first line of the above expression indicates the joint welfare of the governments when the home country faces a high political pressure, multiplied by the probability of a high political pressure in the home country. The second line gives the joint
welfare when political pressure is low, multiplied by the probability of a low shock.

An optimal mechanism is one that maximizes the expected joint welfare of the governments, (5), subject to the incentive compatibility constraints (3) and (4). The optimal solution is shown graphically in Figure (1). In this figure, points A and A’ represent the first-best tariff pairs under low and high political pressures, respectively. The circular curves centered around A (A’) are the joint political welfare contours when political pressure at home is low (high). The outcome of the bargaining game is given by points B and B’. The curve that goes through B and B’ is one of the home country’s iso-welfare contours under low political pressure. This implies that when political pressure in the home country is low, the home government is indifferent between B and B’. Therefore, the tariff pair given by B will be implemented when the home country is facing low political pressure. On the other hand, B’ will be the tariff pair implemented under high political pressure, as under such conditions the home government will be strictly better off at point B’.

As high shocks become more likely, i.e., if ρ goes up, the curve B-B’ shifts towards A’. As a result of this shift, the tariff pair under high political pressure becomes more efficient (since B’ gets closer to A’), while it becomes less efficient under low pressure (since B will be farther away from A). In an extreme case where ρ = 1, B’ coincides
with A’, meaning that the tariff pair under high political pressure coincides with the first-best outcome. That is because when \( \rho = 1 \), there is no asymmetric information and the mechanism’s outcome must be efficient. Similarly, when \( \rho = 0 \), B coincides with A.

4 Renegotiation in the Presence of the WTO Court

Following Beshkar (2007), I assume that the DSB is an impartial entity that receives a noisy signal (through investigations or court hearings) about the state of the world and announces this signal publicly. Denoting the DSB's signal by \( \theta_{DSB} \), I assume that \( \theta_{DSB} \) matches the true state of the world with probability \( \gamma > \frac{1}{2} \), i.e.,

\[
\Pr (\theta_{DSB} = \theta | \theta = \theta) = \Pr (\theta_{DSB} = \overline{\theta} | \theta = \overline{\theta}) = \gamma.
\]

As will be seen below, the public signal generated by DSB can improve the efficiency of the tariff bargaining by mitigating the information asymmetry between the trading partners.

Similar to the previous section, here I consider the problem of designing an incentive-compatible direct revelation mechanism that maximizes expected joint welfare of the parties. The difference here is that in addition to the importing country’s announcement about its realized political pressure, we also have the DSB’s public announcement of its signal. An assumption regarding the sequence of these announcements is consequential in the design of the optimal mechanism. Given that the DSB’s rulings are not binding, which implies that a defending country is free to make a decision about its trade policy after the DSB’s ruling, it seems most appropriate to assume that the DSB’s announcement precedes that of the defending country. Moreover, in this section I assume that DSB gets involved in the dispute and makes its announcement automatically, i.e., without a request from the parties. I will relax this assumption in Section 6 where I study pre-trial settlement negotiations.

Therefore, I assume that the sequence of events is as follows:

1. Parties commit to a mechanism.
2. Political pressure, \( \theta \), in the home country is realized and observed privately by the home government.

3. DSB receives a noisy signal, denoted by \( \theta_{DSB} \), about the political pressure in the home country and announces it publicly.

4. Home government makes an announcement, denoted by \( \theta_d \), about its political pressure.

5. The mechanism determines the tariff pair \((\tau, r)\) to be adopted by the parties. Note that the DSB’s announcement together with the home (i.e., defending) country’s announcement determine the outcome of the mechanism. Therefore, the optimal solution is summarized by two entries, namely, \( \tau(\theta_d, \theta_{DSB}) \) and \( r(\theta_d, \theta_{DSB}) \).

There are four incentive compatibility constraints that must be satisfied. First, suppose that the home country is facing a high political pressure and the DSB has also observed a signal of high political pressure, i.e., \( \theta_{DSB} = \overline{\theta} \). The home government will report its type truthfully if and only if:

\[
W(\tau(\overline{\theta}, \overline{\theta}), r(\overline{\theta}, \overline{\theta}) ; \theta) \geq W(\tau(\theta, \theta) , r(\theta, \theta) ; \overline{\theta}).
\] (6)

If the true state of the world is \( \theta = \underline{\theta} \), but the DSB’s signal shows a high political pressure, the home government will have the incentive to report a low political pressure if and only if:

\[
W(\tau(\underline{\theta}, \overline{\theta}) , r(\underline{\theta}, \overline{\theta}) ; \theta) \geq W(\tau(\overline{\theta}, \overline{\theta}) , r(\overline{\theta}, \overline{\theta}) ; \theta).
\] (7)

The remaining two incentive compatibility constraints are for situations where the DSB receives a signal of low political pressure. If this signal matches the true state of the world, then the incentive compatibility constraint is given by

\[
W(\tau(\theta, \theta), r(\theta, \theta) ; \theta) \geq W(\tau(\overline{\theta}, \overline{\theta}) , r(\overline{\theta}, \overline{\theta}) ; \theta).
\] (8)

Finally, if the DSB’s signal of low political pressure differs from the true state of the world, the home government has the incentive to report its high political pressure
truthfully if and only if

\[
W (r (\theta, \theta), r (\theta, \theta); \theta) \geq W (r (\theta, \theta), r (\theta, \theta); \theta). \tag{9}
\]

The expected joint welfare of the governments, which will be used as to measure the mechanism’s performance, can be introduced as follows. First, consider a situation where the home country is under high political pressure. With probability \(\gamma\), the DSB observes a signal of high political pressure and with probability \(1 - \gamma\), the DSB observes a low-pressure signal. Thus, given high political pressure in the home country, the expected joint welfare is

\[
\gamma \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right] \\
+ (1 - \gamma) \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right].
\]

Now consider the case where the home government is facing low political pressure. The DSB’s signal in this case will be a low political pressure with probability \(\gamma\), and a high political pressure with probability \(1 - \gamma\). Therefore the expected joint welfare under low political pressure is

\[
\gamma \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right] \\
+ (1 - \gamma) \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right].
\]

The first case above, i.e., a high political pressure, is realized with probability \(\rho\) and the second case occurs with probability \(1 - \rho\). Thus, ex ante, that is, before the realization of the state of the world, the expected joint welfare of the governments is given by

\[
\rho \gamma \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right] \\
+ \rho (1 - \gamma) \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right] \\
+ (1 - \rho) (1 - \gamma) \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right] \\
+ (1 - \rho) \gamma \left[ W (r (\theta, \theta), r (\theta, \theta); \theta) + W^* (r (\theta, \theta), \tau (\theta, \theta); \theta) \right]. \tag{10}
\]

The problem of designing a direct revelation bargaining mechanism will be to
maximize (10) subject to incentive compatibility constraints (6 – 9). The optimal solution can be demonstrated by four tariff pairs, namely, C, C’, D, and D’, depicted in Figure (2). The curves going through C-C’ and D-D’ are two iso-welfare contours of the home country under low political pressure.

If \( \theta_{DSB} = \overline{\theta} \), then the equilibrium tariff pair is either C or C’, depending on the home country’s true state of the world. Under low political pressure, the home country will be indifferent between C and C’, and I assume that it will choose C to maximize the joint welfare of the governments. Under high pressure, however, the home country will be strictly better off at C’ than C, so it will announce a high political pressure and C’ will be the outcome of the bargaining game.

If the DSB observes a low pressure signal, i.e., \( \theta_{DSB} = \underline{\theta} \), then the equilibrium tariff pair is either D or D’. Similar to the previous case, the home country is indifferent between D and D’ when it faces low political pressure and I assume it will

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10 Although not modeled explicitly, it is assumed that the entire mechanism introduced in this paper is sustainable through repeated interactions between the parties. In other words, parties have the incentive to respect the rules of negotiations (such as limiting retaliations to what is specified by the mechanism) in order to guarantee a sustainable relationship in the long run. Interested readers are referred to Beshkar (2007) and Park (2009) for the study of the DSB in a repeated game setting.
choose D so that the joint welfare is maximized. Moreover, if the home country faces high pressure, it will be strictly better off by announcing a high pressure that results in adopting tariff pair D’.

Note that the DSB’s announcement has the effect of “framing the renegotiations.” If the DSB rules in favor of the home country by stating that the home country is facing high political pressure, the subsequent bargaining game between the governments is to mutually agree on either C or C’. In contrast, if the DSB announces a low political pressure in the home country, the governments bargain over D and D’. Loosely speaking, the defending party (here the home country) will have the upper hand in renegotiations if the DSB issues an opinion favorable to the defendant. Similarly, if the DSB’s opinion is against the defending party, the complaining party will be in a better bargaining position.

To understand the source of welfare gain from introducing the DSB, compare the equilibrium outcomes when there is no DSB, given by B and B’, and the equilibrium outcomes under the DSB, given by C, C’, D, and D’. First, consider a situation where the home country is facing a high political pressure. In this case, bargaining without the help of the DSB results in tariff pair B’. But in the presence of the DSB, there is a high chance (i.e., $\gamma > \frac{1}{2}$) that C’ will be chosen by parties, which is associated with a higher joint welfare. The downside of the bargaining under the DSB is that with a low probability ($1 - \gamma$), the DSB may make a wrong judgment that results in the less efficient tariff pair D’. But the expected joint welfare will be higher under the DSB as long as the DSB’s signal is informative (i.e., $\gamma > \frac{1}{2}$). The same story is true when the home country is facing a low political pressure. In that case, in absence of the DSB, the bargaining outcome is given by B, while in the presence of the DSB the bargaining outcome may be at D with probability $\gamma > \frac{1}{2}$.

4.1 Comparative Statics

As the DSB’s signal becomes more accurate, that is when $\gamma$ becomes closer to 1, C-C’ will shift to the right and down and D-D’ shifts to the left and up. That is because as the DSB becomes more accurate in observing the true state of the world,
the cost of making a wrong judgment becomes less of a concern and the DSB can be more aggressive in its rulings in favor or against the home country. In the extreme case of $\gamma = 1$, D will coincide with A, while C’ will coincide with A’, meaning that bargaining results in the first-best outcome.

For a given value of $\gamma$, an increase in $\rho$ moves both C-C’ and D-D’ to the right and down. The shift of D-D’ to the right and down reflects the fact that when a high pressure is more likely, the DSB wants to reduce the cost of wrong rulings when the true pressure is high. Moreover, C-C’ shifts in the same direction because the probability of low pressure is now smaller and the expected cost of a wrong judgment when a high pressure signal is observed is reduced. When $\rho = 1$, there will be no asymmetric information and A’, C’, and D’ will coincide.

5 Implementation of the Optimal Mechanism

The previous section laid out a ‘direct’ revelation mechanism in which the bargaining outcome is uniquely determined by the respective announcements of the court and the defending party. As is well-known in the mechanism design literature, the outcome of a direct revelation mechanism may be obtained through other institutional designs. My objective in this section is to offer an institutional design that resembles the actual dispute settlement process of the WTO while replicating the same outcome as the direct mechanism found above.

Under the direct mechanism of Section 4, the defending country has to choose one of the two tariff pairs that are recommended by the DSB. However, due to lack of enforcement power on behalf of the DSB, the defending party can choose any tariff that it deems necessary and the DSB can only determine the maximum level of retaliation by the complaining party. It turns out that despite its lack of enforcement power, the dispute settlement process can be designed in a way that induces the defending country to choose, voluntarily, the second best outcome calculated in Section 4.

Consider two countries that have agreed on a pair of tariff bindings given by point D in Figure 3, which is a reproduction of Figure 2. For simplicity, suppose that
when a country violates the tariff binding it sets a tariff rate equal to the politically efficient tariff under high political pressure, i.e., $\tau^{PE}(\overline{\theta})$. In case of violation of tariff bindings, the DSB investigates the state of the world and recommends an adjustment in the defending country’s trade policy. In particular, if the DSB receives a low-pressure signal, it will recommend the defending party to respect the negotiated tariff bindings and reduce its tariff from $\tau^{PE}(\overline{\theta})$ to $\tau_D$. If the defendant insists on the necessity of increased protection, then the complaining party will be authorized to retaliate according to Menu $L$. Menu $L$ is the upper envelope of the home iso-welfare contours under low and high political pressures that go through point $D'$. Under this retaliation scheme, the home government would respect the recommendation of the DSB if it faces a low political pressure and will choose point $D'$ if it faces a high political pressure. Note that under Menu $L$ the home government is indifferent between choosing the tariff rate associated with $D'$ or higher tariffs if it is under high pressure.

If the DSB observes a high political pressure, it will recommend the defending party to reduce its tariff from $\tau^{PE}(\overline{\theta})$ to $\tau_E$, where $\tau_D < \tau_E < \tau^{PE}(\overline{\theta})$. In this case if the defending party wants to impose a tariff higher than $\tau_H$, the complaining party will be authorized to retaliate using the retaliation menu $H$. As shown in Figure 3, Menu $H$ is the upper envelope of the home iso-welfare contours under low and high political pressures that go through point $C'$.

Menu $H$ also provides a basis for the complaining party to offer a reduction in its own tariffs to induce the defending party who faces low pressure to choose point $C$. Whether this second best outcome is implementable depends on the constraints that negotiators face. For example, if the negotiators of the exporting country do not have the discretion to offer a reduction in their import tariffs, tariff pair $C$ may never be chosen, in which case the outcome will be the tariff pair $E$.

## 5.1 The DSB’s Biased Ruling Pattern

An interesting feature of the optimal ruling decision calculated above is that it always recommends a cut in the defending party’s tariff rate. In other words, according
Figure 3: Tariff pair D (tariff pair E) is the reference point determined by the DSB when a low-pressure (high-pressure) signal is observed. Moreover, the renegotiation rule is given by the punishment menu L (menu H).
to this optimal ruling, the DSB should always rule against the defending party. Nevertheless, the extent of the recommended tariff cut depends on the assessment of the DSB from the state of the world.

The data on the official rulings of the DSB reveals a high disparity between the success rates of the complaining and defending parties. As reported by Colares (2009), the DSB rules against the defending party in more than 88 percent of cases where the subject of dispute is related to trade remedies.\textsuperscript{11} In some categories of disputes this disparity is even more dramatic. For example, in litigations regarding the safeguard measures adopted to protect domestic industries against potentially harmful surge in imports, the DSB has always ruled against the defending party (Sykes 2003).

Some observers have interpreted this pro-complainant ruling pattern as unsatisfactory. For example, Sykes (2003) and Grossman and Sykes (2007) argue that the DSB’s interpretation of the WTO Agreement has made it increasingly difficult for the governments to resort to the escape clause, which frustrates the purpose of the WTO Agreement on Safeguards. Colares (2009) attributes the DSB’s bias to the normative views of the individuals who are involved in the DSB and argues that the asymmetrical pattern of the DSB’s ruling is “the result of a process of authoritative normative evolution (i.e., rule development) that has expressed itself with a tilt favoring complainants.”

The results of this paper, however, suggest that the seemingly biased rulings of the DSB may be part of an optimal dispute settlement mechanism. In particular, if the DSB finds some evidence in favor of the defending party, it would be optimal to advise a tariff level that is lower than the disputed tariff but higher than the original bindings. Therefore, even in the case of a finding in favor of the defendant the DSB’s ruling will seem anti-defendant as it recommends a cut in the level of protection afforded.

\textsuperscript{11}For non-trade remedy cases this rate is 83.33%.
5.2 Renegotiation Proofness

The mechanism introduced above maximizes the ex ante joint welfare of the parties subject to incentive constraints. However, ex post, this mechanism does not generate a Pareto optimal result if the true state of the world is $\theta = \theta_1$. To see this note that if $\theta = \theta_1$ then the iso-welfare contour of the home country will not be tangent to the iso-joint-welfare contours at points C' and D' in Figure 3. This implies that if the mechanism generates either of these tariff pairs, the parties have the incentive to renegotiate away from the suggested tariff pair. Therefore, if the parties cannot commit not to renegotiate the outcome of the mechanism, this mechanism cannot be implemented as designed.

It is, however, easy to modify the above mechanism to ensure that its outcome is renegotiation-proof under all states of the world. In particular, one can restrict the choice of tariff pairs to the set of Pareto optimal tariff pairs under the realized political pressure. Figure 4 depicts the optimal renegotiation-proof mechanism. As can be seen in this figure, tariff pairs D' and C' are now Pareto optimal since at these

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12 The ex-post result is Pareto optimal if the true state of the world is $\theta = \theta_1$. 

Figure 4: An optimal renegotiation-proof mechanism.
points the iso-welfare curve of the home country under high pressure is tangent to the iso-joint-welfare contours under high pressure. Obviously, requiring the mechanism to be renegotiation-proof reduces the ex ante expected joint welfare of the parties. However, the comparative statics in this case is qualitatively similar to the case without the renegotiation-proofness requirement.

6 Pretrial Settlement Bargaining

So far I have focused on post-trial negotiations in the WTO and interpreted such negotiations as part of an optimal dispute resolution mechanism. In this section I complete the above model by allowing for pre-trial settlement negotiations. Obviously if litigation in the WTO is costly, settling a dispute without trial would save the parties the cost of litigation. But is pre-trial negotiation valuable if litigation costs are negligible? This question becomes particularly relevant when the stake at dispute is very large compared to the monetary cost of litigation, which may include attorney fees, cost of gathering information, etc.

To find an answer to this question I assume zero litigation costs and investigate whether an exporting country would invoke a formal dispute after observing any positive level of violation. That is, whether an exporting country is willing to show tolerance to relatively minor violations of the agreement by importing countries. If the answer to this question is affirmative then the relevant question is whether importing countries would show enough restraint in the use of trade barriers so that the exporting countries would tolerate it.

To understand the incentive of the parties to pursue an out-of-court settlement when litigation costs are zero, note that the joint welfare of the governments is a concave function of the tariffs. Therefore, governments may find a pre-trial settlement mutually beneficial in lieu of the uncertain court’s outcome.\textsuperscript{13}

Consider the following pre-trial negotiation game. Assume that after the realiza-

\textsuperscript{13}Viscusi (1988) also studies the effect of risk aversion in product liability disputes on the outcome of settlement negotiations but in a symmetric information setting.
tion of the state of the world, the importing country proposes a tariff pair \( t = (\tau, r) \), where \( \tau \) denotes the importing country’s tariff in the political sector and \( r \) denotes the exporting country’s retaliatory tariff. If the exporting country accepts this proposal, there will be no litigation. Otherwise, the dispute escalates to the DSB and the game will continue as described in Section 5. Namely, if the DSB rules against the importing country, the resulting tariff pair will be either \( D \) or \( D' \) in Figure 3 (depending on the true type of the importing country); and if the DSB rules against the importing country, the resulting tariff pair will be either \( C \) or \( C' \).

This is a signaling game in which the importing country (i.e., the defendant) is the sender and the exporting country (i.e., the complainant) is the receiver. The proposed tariff pair, \( t \), will be understood as a signal of the importing country’s type (i.e., level of political pressure) and the threat of litigation is the cost that is associated with this signal. The following is the list of new notations that will be employed in the analysis of this signaling game:

- \( W^X(t) \): Exporting country’s welfare under tariff pair \( t \).
- \( W^M(t; \theta) \): Importing country’s welfare under tariff pair \( t \) and political pressure \( \theta \).
- \( W(t; \theta) \): Joint welfare: \( W^M(t; \theta) + W^X(t) \).
- \( P_\theta \): Set of Pareto efficient tariffs when political pressure is \( \theta \in \{ \theta, \bar{\theta} \} \).

As a starting point in analyzing the equilibrium, consider the exporting country’s incentive to settle if it believes that the importing country’s political pressure is low. In this case, the exporting country will be (weakly) better off by accepting \( t \) if and only if

\[
W^X(t) \geq \gamma W^X(t_D) + (1 - \gamma) W^X(t_C).
\]

It is shown in the Appendix that,

**Lemma 1** Defining \( t_1 \in P_\theta \) such that

\[
W^X(t_1) = \gamma W^X(t_D) + (1 - \gamma) W^X(t_C),
\]  

(11)
we have

\[ W^M(t_l; \theta) > \gamma W^M(t_D; \theta) + (1 - \gamma) W^M(t_C; \theta). \]

(12)

This Lemma states that when the importing country’s (revealed) type is \( \theta \), the tariff pair \( t_l \) makes the exporting country indifferent between settlement and litigation, while the importing country is strictly better off if a settlement with \( t = t_l \) is achieved (inequality 12). Using this lemma, it can be shown that:

**Lemma 2** There exists no pooling equilibrium of the pre-trial settlement bargaining game.

**Proof.** In a pooling equilibrium either all cases are litigated or all cases are settled. The former is not possible because as shown in Lemma 1, there exists a settlement proposal \( t = t_l \) that is strictly preferred to litigation by a low-type importing country, while it makes the exporting country indifferent between settlement and litigation. Moreover, if the high type pool with the low type and set \( t = t_l \), the exporting country will prefer settlement to litigation. Therefore, litigating all cases cannot be an equilibrium play. The latter case, i.e., settling all cases, is not an equilibrium either, because it would mean that a rigid agreement, which specifies a single tariff pair regardless of the state of the world, generates a higher joint welfare than the court mechanism. This is not possible if the court is designed optimally. ■

I will focus on hybrid equilibria of this signaling game, which may include a set of separating equilibria as special cases. In a hybrid equilibrium, a high-type importing country has a pure strategy in the equilibrium, which I denote by \( t_h \). On the other hand, the strategy of a low-type importing country is to randomize between \( t_l \) and \( t_h \). Formally, let \( \alpha \) denote the strategy of a low-type importing country, which is the probability of proposing \( t_h \) instead of \( t_l \). The exporting country’s equilibrium strategy will be to accept a settlement proposal when \( t = t_l \) (see 1), and to reject \( t = t_h \) with probability \( \beta \).

As will be discussed in the proof of the following proposition, there exists a continuum of Perfect Bayesian Equilibria. However,

\[^{14}\text{Note that } \alpha = 0 \text{ would indicate a separating equilibrium.}\]
Proposition 3 Among Perfect Bayesian Equilibria of the pre-trial bargaining game, there is a unique equilibrium that maximizes the joint welfare of the parties.

Therefore, in the equilibrium a high-type importing country proposes \( t^*_h \), while a low-type importing country randomizes between \( t_l \) and \( t^*_h \) with probabilities \( \alpha^* \) and \( 1 - \alpha^* \), respectively. The equilibrium strategy of the exporting country is to accommodate \( t = t_l \), and to challenge \( t = t^*_h \) (i.e., litigate) with probability \( \beta^* \in (0,1) \).

This equilibrium predicts that a low-type importing country is always in violation of the agreement even if it ‘separates’ itself from the high type by proposing \( t = t_l \). That is because according to the trade agreement, \( t_D \), which generates a higher payoff than \( t_l \) for the exporting country, is the tariff pair that must be chosen when political pressure is low in the importing country.

The model predicts that in each period the fraction of tariff lines that are subject to a dispute is given by \( (1 - \rho) \alpha^* + \rho \), from which only a fraction, \( \beta^* \), are litigated (a * represents equilibrium values). Moreover, settlement bargaining affects the combination of cases that reach the formal trial. In particular, in a dispute that is brought before the DSB, the probability that the disputed measure is legitimate is given by \( \frac{\rho \beta^*}{\rho \beta^* + (1 - \rho) \alpha^*} \) or simply \( \frac{\rho}{\rho + (1 - \rho) \alpha^*} > \rho \). In other words, the pre-trial settlement bargaining process weeds out a fraction of potential trade policy adjustment proposals that pursue a purely protectionist objective. Therefore, pre-trial bargaining improves the efficiency of the trade relationship by reducing the chance that a purely protectionist measure is authorized by the WTO.

7 Conclusion

Besides shedding light on the workings of the WTO dispute settlement process, the proposed model is particularly useful in guiding empirical investigations of this institution. The existing models mostly focus on one stage of the dispute settlement process and, thus, do not capture the effects that other stages might have on the operation of the stage under study. For example, the general direction of the rulings of
the DSB in disputes regarding safeguard measures (studied by Sykes 2003 and Grossman and Sykes 2007) may not be indicative of the system’s partiality because the cases that are brought before the DSB are not randomly chosen from the universe of potential disputes. In contrast to the existing models, my model captures the important stages of the dispute settlement process, namely, dispute generation, selection of disputes for litigation, the DSB’s decision making, compliance, and retaliation.

The proposed model can be extended in several ways. First, the model can be extended by assuming that the complaining parties also receive a noisy signal about the state of the world. This extension would provide a richer setting to study pre-trial bargaining.

Moreover, in this paper I considered countries that are symmetric in political and technological parameters. This assumption greatly simplifies the problem as any proposed mechanism generates the same expected welfare for the negotiating parties and, therefore, no conflict arises in the stage of designing the agreement. An important area for future research is to consider countries that are asymmetric in technology or political parameters. Such an extension of the model would be particularly useful in understanding agreements between developing and developed countries as well as agreements between countries with different political structures.

8 Appendix

Calculation of the welfare functions. World market clearing condition for good $x$ is $D_x (p_x) + D^*_x (p_x - \tau) = Q_x (p_x) + Q^*_x (p_x - \tau)$. Substituting for the supply and demand functions from (1) and (2), the market clearing condition can be rewritten as $2 - 2p_x + \tau = p_x + b (p_x - \tau)$. Solving for $p_x$ yields $p_x = \frac{2 + (1 + b)\tau}{3 + b}$. Similarly, using the world market clearing condition for good $y$, the home market price for good $y$ can be calculated; $p_y = \frac{2(1 - \tau^*)}{3 + b}$.

The consumers’ surplus from consumption of good $x$ is

$$\psi_x (\tau) = \int_{p_x}^{1} D_x (u) \, du = \frac{1}{2} - p_x + \frac{1}{2} p^2_x = \frac{1}{2} \left( \frac{(1 + b)(1 - \tau)}{3 + b} \right)^2.$$
Similarly, the consumers’ surplus from consumption of good $y$ can be obtained by using $p_x$:

$$
\psi_y(\tau^*) = \frac{1}{2} \left( \frac{1 + b + 2\tau^*}{3 + b} \right)^2.
$$

The producers’ surplus in sector $x$ of the home country is

$$
\pi_x(\tau) = \int_0^{p_x} Q_x(u) \, du = \frac{1}{2} p_x^2 = \frac{1}{2} \left( \frac{2 + (1 + b) \tau}{3 + b} \right)^2.
$$

The producers’ surplus in sector $y$ of the home country is

$$
\pi_y(\tau^*) = \int_0^{p_y} Q_y(u) \, du = \frac{1}{2} b p_y^2 = 2b \left( \frac{1 - \tau^*}{3 + b} \right)^2.
$$

The import demand is given by:

$$
M(p_x) = D_x(p_x) - Q_x(p_x) = 1 - 2p_x = \frac{b - 1 - 2(1 + b)\tau}{3 + b}.
$$

Therefore, the government’s tariff revenue is

$$
T(\tau) = \tau M_x(p_x(\tau)) = \frac{(b - 1)\tau - 2(1 + b)\tau^2}{3 + b}.
$$

 Politically weighted welfare from the importing sector in home country is given by

\[ u(\tau; \theta) = \psi_x(\tau) + \theta \pi_x(\tau) + T(\tau) \]

\[ = \frac{1}{(3 + b)^2} \left\{ \frac{1}{2} (1 + b)^2 + 2\theta + [2\theta(1 + b) - 4]\tau + \left[\frac{1 + 2\theta}{2}(1 + b)^2 - 2(3 + b)(1 + b)\right] \tau^2 \right\}. \tag{13} \]

Moreover, the home government’s welfare from the exporting sector is:

\[ v(\tau^*) = \psi_y(\tau^*) + \pi_y(\tau^*) = \frac{1}{(3 + b)^2} \left\{ \frac{(1 + b)^2}{2} + 2b + 2(1 - b)\tau^* + 2(1 + b)\tau^* \right\}. \]
For further use, note that
\[ u''(\tau; \theta) = -\frac{(1 + b)(11 + 3b - \theta(b + 1))}{(3 + b)^2}, \]
\[ v''(\tau^*) = \frac{4(1 + b)}{(3 + b)^2}, \]
which implies that \(|u''(\tau; \theta)| > v''(\tau)|. \]

**Proof of Lemma 1.** Let \( \tau_k \) be defined implicitly by \( v(\tau_k) = \gamma v(\tau_D) + (1 - \gamma) v(\tau_C) \). Then, since \(|u''(\tau; \theta)| > v''(\tau)| \) (see the first item in the appendix) we must have \( u(\tau_k; \theta) > \gamma u(\tau_D; \theta) + (1 - \gamma) u(\tau_C; \theta) \). Similarly, let \( r_k \) be defined implicitly by \( v(r_k) = \gamma v(r_D) + (1 - \gamma) v(r_C) \), which then implies that \( u(r_k; \theta) > \gamma u(r_D; \theta) + (1 - \gamma) u(r_C; \theta) \). Therefore, we have
\[ u(\tau_k; \theta) + v(r_k) > \gamma [u(\tau_D; \theta) + v(r_D)] + (1 - \gamma) [u(\tau_C; \theta) + v(r_C)]; \]
and
\[ u(r_k; \theta) + v(\tau_k) > \gamma [u(r_D; \theta) + v(\tau_D)] + (1 - \gamma) [u(r_C; \theta) + v(\tau_C)]. \]

These two inequalities imply that both parties strictly prefer settlement to litigation if \( t = t_k \equiv (\tau_k, r_k) \). Therefore, there must exist \( t_l \in P_\theta \) such that if \( t = t_l \), the exporting country is indifferent between litigation and settlement, while the low-type importing country is strictly better off by settlement. ■

**References**


WTO. *Dispute Settlement Understanding*. World Trade Organization.