

# Evidence of Power Considerations in WTO Dispute Settlement

Sebastian Wilckens\*

August 2007

*Very First and Preliminary Version*

## Abstract

The usage of the WTO Dispute Settlement System (DSS) is dominated by high income countries. Since the ultimate enforcement threat of the system is based on retaliation, countries may take their economic size as well as their specific bilateral retaliatory capacity into account when deciding whether or not to respond to a detrimental infringement of a trade agreement by filing a costly complaint. Hence, various scholars conjecture that lawsuits surfacing in the record of the WTO constitute only the biased tip of an iceberg of trade disputes. In order to investigate such a potential bias, this paper sets up a sequential game of the DSS. Subsequently, a binary choice model is employed to empirically explain a country's decision whether or not to litigate against a trading partner. The results suggest that a country is more likely to file a complaint if (i) it is large, (ii) its trading partner is small, (iii) the trade value of the commodity at stake is large and (iv) its retaliatory capacity is large.

*Keywords: Developing Countries, Dispute Settlement, GATT/WTO, Tariff Retaliation, Trade Disputes*

*JEL Classifications: F13, K33, O19*

---

\*Correspondence: Department of Economics, Christian-Albrechts-Universität zu Kiel, Wilhelm-Seelig-Platz 1, D-24098 Kiel, Germany, wilckens@economics.uni-kiel.de. I would like to thank Horst Raff and Rolf J. Langhammer as well as participants of the Brown-Bag-Seminar at the University of Kiel for helpful comments and suggestions.

# 1 Introduction

With the establishment of the WTO in 1995, the Dispute Settlement Body (DSB) has gained much importance as an institution in the world trading system. While a panel's decision in the GATT era became a ruling only by consensus, the panel decisions under the WTO's DSS become a ruling unless there is a consensus against it. This modification is a candid commitment to encouraging complaints of members that have suffered from a contract breach of their trading partners. However, the WTO does not possess any supranational sovereignty to enforce compliance with the rules-based trading system by imposing sanctions or fines. As a consequence, the ultimate enforcement threat of a panel ruling is based on the retaliatory capacity of the victorious complainant. While it may be worthwhile for an economically large country to implement authorized retaliatory countermeasures against a trading partner, an economically small country may shoot itself in the foot by doing so.<sup>1</sup>

An example of this discrepancy is found in the prominent Bananas Dispute (i.e. DS16 and DS27), in which the United States (US) and several Latin American countries complained against the bananas import regime of the European Communities (EC), which favored bananas from the African, Caribbean and Pacific countries (ACP). Although the panel decided in favor of the complainants, the EC refused to bring their import regime into compliance with the ruling. Upon their request, Ecuador and the US were authorized to suspend concessions to the EC as a retaliatory measure.<sup>2</sup> In the outcome of this dispute the EC did not bring its import regime into conformity with the rules of the WTO, the US implemented their retaliatory measures, while Ecuador was reluctant to do so. Many experts e.g. Bronckers & van den Broek (2005)[5] or Subramanian & Watal (2000)[19] agree in arguing that Ecuador was virtually unable to implement retaliatory measures unless it would like to hurt its own economy even more.<sup>3</sup> At the end of the day of this dispute, the EC kept the benefits

---

<sup>1</sup>It is a well known fact that a small country's optimal import tariff equals zero since a small country cannot influence world market prices, i.e. it faces a completely elastic supply. Kennan & Riezman (1988)[14] set up a two country model where they show by means of varying elasticities that once a country is large enough, it may gain from a tariff war as compared to free trade.

<sup>2</sup>Ecuador was authorized to suspend import concessions to the EC of an amount of 201.6 million US-Dollars (USD), while the US were authorized to suspend concessions to the EC of an amount of 191.4 million USD.

<sup>3</sup>Note that even the arbitrators of this particular case acknowledged this problem in WT/DS27/ARB/ECU, para 177 by stating that "... it could be that Ecuador may find itself in a situation where it is not realistic or possible for it to implement the suspension authorized by the DSB for the full amount of the level of nullification and impairment estimated by us in all of the sectors and/or under all agreements mentioned above combined."

of maintaining an illegal import regime, the US got at least a little compensated for the losses in the bananas business by the implementation of import barriers against the EC, while Ecuador was left with nothing but an injured bananas export sector.

Such a potential inability of economically smaller countries to enforce an offending trading partner’s compliance may render the usage of the DSS less attractive for smaller than for larger countries. This effect may in turn show up in the data as a bias against smaller countries. Table 1 provides a breakdown of all complaining and defending countries from 1995 through 2005, grouped according to the World Bank’s income classifications.<sup>4</sup> Clearly the

Complainant\Defendant	High	Upper Middle	Lower Middle	Low	Sum
High	151	33	21	17	222
Upper Middle	28	19	12	1	60
Lower Middle	42	13	7	2	64
Low	14	5	2	1	22
Sum	235	70	42	21	368

Table 1: Usage of the DSS by Countries’ Income Groups from 1995 through 2005

figures of Table 1 show that economically larger countries filed the majority of all complaints. Moreover, these countries dominate the system as well among the defendants. However, this observation is not necessarily a proof for the claim that the DSS is biased against smaller countries. Horn et. al. (1999)[11] show that a model, in which countries encounter random violations proportionately to the diversity and value of their trade, explains the observed pattern of disputes quite reasonably.<sup>5</sup> Hence, Horn et. al. (1999)[11] do not take the numbers of observable disputes as evidence of power considerations in dispute settlement. However, there is a caveat against this approach since it may be the case that the set of observable disputes constitutes only a biased subset of all disputes. There is reason to believe that the dark figure of disputes exhibits a pattern that differs from the pattern of the observable disputes. Smaller countries may not find it worthwhile to spend litigation costs

---

Moreover, the arbitrators notice that the Dispute Settlement Understanding (DSU) is not prepared for such a case in WT/DS27/ARB/ECU, para 177: “*The present text of the DSU does not offer a solution for such an eventuality.*”

<sup>4</sup>The figures on the notified disputes are taken from the author’s own dataset, which is based on the record of disputes on the WTO’s website. Income classifications of countries correspond to the World Bank’s classification scheme.

<sup>5</sup>The underlying assumption of this class of models is that a dispute is generally undesirable for a country. In order to be still able to explain the occurrence of disputes, a demon, which possesses policymakers from time to time and leads them to irrational behavior, is introduced. This demon approach was established by Kovenock & Thursby (1992)[15].

on a complaint in anticipation of their inability to enforce even an affirmative panel ruling. If this would prove true, the result of Horn et. al. (1999)[11] would have to be questioned since it would no longer mean that no power considerations are present at all but rather that power considerations are absent among those countries which are already powerful enough to find complaining worthwhile.

Bown (2005)[2] proposes an approach which addresses these concerns. He compiles a data set of those disputes, where all victim countries, that have suffered from the defendant's offense, are known with certainty. Subsequently, Bown regresses the binary decision of whether or not a country has filed a complaint on several country specific and dispute specific variables. All in all, Bown's empirical results generally suggest that economically small countries indeed face a severe disincentive in complaining as opposed to economically larger countries.

Yet another empirical approach that deals with a presumed bias of the DSS' usage is presented by Guzman & Simmons (2005)[8]. They address the question whether a country of a given size rather complains against a offenders of equal size or against offenders of larger size. Guzman & Simmons (2005)[8] interpret their results in a way that lets them deny the presence of power considerations.

This paper tries to shed light on the question of what determines whether a country does or does not file a complaint against an offending trading partner. It aims at providing a non-random theoretical explanation that allows for rationally acting countries and is consistent with the data. Therefore, section 2 sets up a game theoretic model of the dispute settlement process. In section 3, predictions on how the different variables should influence a country's decision whether or not to file a complaint are derived. Subsequently, in section 4, a statistical criterion is derived and employed to create a data set of 2,409 countries that are likely to have suffered in the course of 185 disputes on import restrictions, ranging from 1995 through 2005. By means of a probit model, the binary complaining decision is regressed on the offender's and the victim's gross domestic product (GDP), the trade value of the disputable commodity at stake and a crude proxy for the retaliatory capacity of the victim in section 5. The results unambiguously suggest that victims do take power considerations into account when deciding whether or not to file a complaint. Thereby the findings of Bown (2005)[2] are confirmed on a broader statistical basis. Section 6 challenges the findings of Guzman

& Simmons (2005)[8] by using the newly compiled data set to re-estimate a model that is similar to Guzman & Simmons'. Section 7 offers concluding remarks and relates the paper's finding to previous literature on this subject.

## 2 The Dispute Settlement Process as a Sequential Game

The Dispute Settlement Process of the WTO (DSP) can be separated into several sequential stages. Initially, the opposing parties have to try to solve the disputes in a consultation phase of 60 days. After that, the establishment of a panel can be requested. The panel usually takes another half of a year to circulate its report. Both parties may appeal once against a ruling. If the panel or appellate body has detected an infringement of a WTO rule, the report will ask the defendant to bring the illegal measure into conformity with the WTO's rules. In case the defendant refuses to comply, the complainant may request the retaliatory suspension of concessions. This retaliatory mechanism is subject to the equivalence condition of the WTO which basically states that the magnitude of retaliation must not be greater than the damage due to the initial infringement. Jordan (2005)[12] provides an assessment of the use and interpretation of the equivalence condition in WTO litigation practice. Accordingly, the dominating approach for the calculation of the authorized retaliatory measure is a counterfactual trade value model.<sup>6</sup> Focusing on disputes that deal with violative import restrictions, this approach first monitors the reduction in the value of the imported goods that have been subject to the disputable measure. This reduction in trade value is seen as the damage that was inflicted. Now in turn, the complainant may be entitled to implement an import barrier or another retaliatory measure that leads to a reduction of the defendant imports' trade value of no more than the damage that was initially inflicted.

In the remainder of this section, this process will be treated in a simplified way. The injured victim can decide whether or not to file a complaint and whether or not to implement retaliatory measures. The offender can just chose whether or not to comply. This simplification just requires the absence of legal failure<sup>7</sup> and that both sides are sure that the disputable trade measure constitutes an infringement of the WTO's rules. Then, there is no

---

<sup>6</sup>This method was used for example in the following cases: DS26 EC-Hormones, DS27 EC-Bananas, DS160 US-Copyright.

<sup>7</sup>The absence of legal failure means that the panel judges every violation to be a violation.

uncertainty with respect to the panel rulings, and under perfect information each party can calculate the payoff associated with the alternative decisions.

The remainder of this section distinguishes between a game of complete information and a game of incomplete information, where the offender is not aware whether the victim is powerful enough to find retaliation worthwhile.

## 2.1 A Game of Complete Information

Suppose an infringement of a bilateral trade agreement has already occurred. Let the offending country be denoted by “ $O$ ” for offender, and let the country which is suffering from the offense be denoted by “ $V$ ” for victim. Assume further that the infringement causes a welfare loss of “ $D$ ” for the victim and a welfare gain of “ $\Pi$ ” for the offender. Then it is up to  $V$  to decide whether or not to file a complaint at cost “ $C$ ”. If  $V$  decides to complain,  $O$  can decide whether to abolish the disputable trade measure (i.e. “comply”) or to maintain it (i.e. “don’t comply”). In case  $O$  complies,  $V$  is relieved of its welfare loss  $D$ , while  $O$  loses its welfare gain  $\Pi$ . Assume that if  $O$  does not comply, the victim can choose between “retaliate” and “don’t retaliate” at this stage. If retaliation is implemented, this affects both the victim’s and the offender’s welfare, so “ $R_V$ ” is added to the victim’s payoff, while the offender’s payoff decreases by “ $R_O$ ”. Figure 1 depicts the structure of the described game in an extensive form representation. The payoff vectors  $(\pi_V, \pi_O)$  are displayed at the end-nodes with  $\pi_V$  as the victim’s payoff and  $\pi_O$  as the offender’s payoff. Before solving the game, it is convenient to rule out one particular odd situation right from the start.

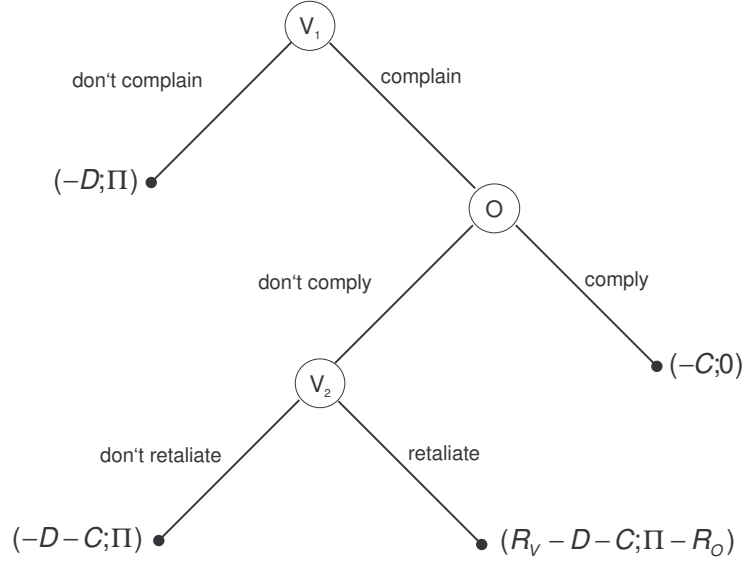
### **Assumption 1:** $R_V \leq D$

Intuition: Since the equivalence condition of the WTO’s Dispute Settlement Understanding (DSU) states that “[t]he level of the suspension of concessions or other obligations authorized by the DSB shall be equivalent to the level of the nullification or the impairment.”<sup>8</sup>, the authorized extent of retaliation is assumed to be limited to a level no higher than the initial damage.

---

<sup>8</sup>DSU Article 22, para 4.

Figure 1: A Game of Complete Information



Solving the game via backward induction, a necessary and sufficient condition for the victim to choose “retaliate” at node  $V_2$  is

$$R_V > 0. \quad (1)$$

At node  $O$ , a necessary and sufficient condition for the offender to chose “comply” is

$$R_O > \Pi \wedge R_V > 0. \quad (2)$$

Finally, there are two sufficient conditions to make sure the the victim chooses “complain” in the first place. One of them is that the offender complies (i.e. condition (2) has to hold) while litigation costs fall short of the damage suffered by the victim:

$$(R_O > \Pi \wedge R_V > 0) \wedge D > C. \quad (3)$$

The second sufficient condition for “complain” does not require the offender’s compliance. If it holds that the victim’s damage and the victim’s welfare gain from retaliation both exceed litigation costs, “complain” becomes a best response independently of the offender’s compliance:

$$R_V > C \wedge D > C. \quad (4)$$

From Assumption 1 and condition (3) and (4) it follows that

$$D > C \quad (5)$$

is an overall necessary condition for “complain”.<sup>9</sup> Since we are eventually interested in the determinants of a country’s decision whether or not to file a complaint in the first place, the sufficient conditions ensuring that a country files a complaint are briefly summarized as follows.

**Proposition 1:** *In a game of complete information, a victim which is suffering from the infringement of a bilateral trade agreement would be expected to file a complaint if*

- (i) *the offender’s loss due to retaliation  $R_O$  is large (condition (3))*
- (ii) *the offender’s gain from the offense  $\Pi$  is small (condition (3))*
- (iii) *the victim’s gain from retaliation  $R_V$  is large (condition (3) and (4))*
- (iv) *the victim’s damage  $D$  exceeds litigation costs  $C$  (condition (3) and (4)).*

## 2.2 A Game of Incomplete Information

The previous subsection’s game of complete information clearly suggests that a victim’s inability to reap any gains from implementing retaliation, as well as its inability to do any harm to the offender, renders “don’t complain” a best response for the former. However, this may not be true in the case of incomplete information, where the offender does not know whether

---

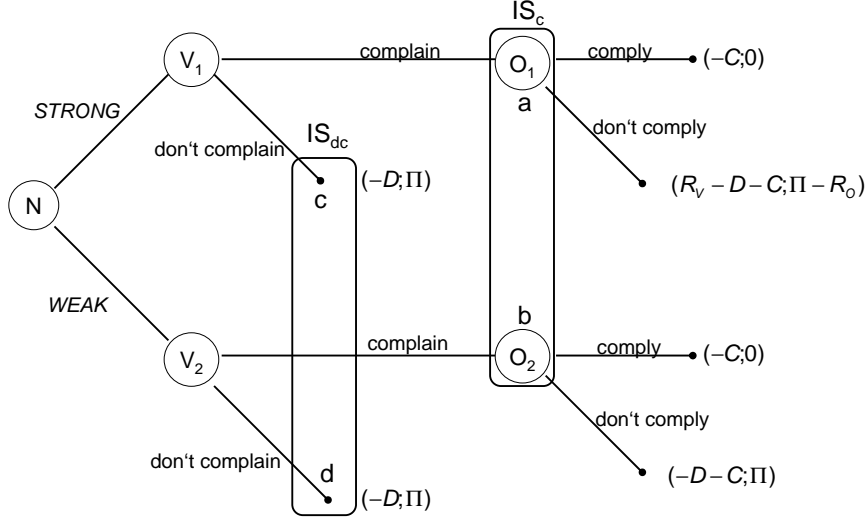
<sup>9</sup>Although  $D > C$  is part of both sufficient conditions, it only becomes a necessary condition if one rules out  $R_V > C + D$ . Therefore it is Assumption 1 (i.e.  $R_V \leq D$ ) which renders  $D > C$  a necessary condition for complaining.

it “pays” for the victim to retaliate or not. Therefore this subsection investigates a violated country’s incentive to complain in an environment of asymmetric information. In particular it is assumed that the victim can be of two different types, either *STRONG* or *WEAK*. Nature moves first and chooses a strong victim with probability  $\gamma$  and a weak victim with probability  $1 - \gamma$ . While the victim knows the realization of its own type, the offender only knows the probabilities  $\gamma$  and  $1 - \gamma$  for the realization of each type. The difference between the two types of victims lies in their ability to retaliate. It is assumed that a victim of strong type realizes a strictly positive welfare gain from the implementation of retaliation ( $R_V > 0$ ) while a victim of weak type experiences either a welfare loss or no welfare effect at all ( $R_V \leq 0$ ). Due to this assumption, a weak victim’s best response in the subgame starting at node  $V_2$  of Figure 1 is “don’t retaliate”, while a strong victim’s best response in this subgame is “retaliate”. Hence the former subsection’s game of complete information can be transformed into a game of asymmetric information with victims of strong type always choosing to retaliate and victims of weak type never choosing to retaliate. Consequently, the offender does not really know whether any potential non-compliance will trigger retaliation or not. As the extensive form representation of this game in Figure 2 shows, the offender can only distinguish whether the victim has chosen to complain and the game arrived at information set  $IS_c$  or the victim has chosen not to complain and the game arrived at information set  $IS_{dc}$ . Before the game can be solved for the players’ best responses, some assumptions on the payoffs have to be made. First, assume the infringement is severe enough in order to make it pay for a victim to trade litigation costs for compliance. This means  $D > C$  has to hold since it constitutes a necessary but not sufficient condition to observe both types of victims complaining in this game.<sup>10</sup> Second, assume the offender’s welfare loss due to retaliation of a strong victim is larger than the former’s welfare gain of the disputable trade measure. This means  $R_O > \Pi$  has to hold in order to render “comply” an offender’s best response at node  $O_1$  and “don’t comply” an offender’s best response at node  $O_2$ . Third, Assumption 1 (i.e.  $R_V \leq D$ ) is required to respect the WTO’s equivalence condition. Moreover, let the

---

<sup>10</sup>Expressed the other way around,  $D \leq C$  is a sufficient condition to render “don’t complain” a best response for victims of weak type. In that case only victims of strong type would complain at all and the information about a complainant’s type would no longer be asymmetric.

Figure 2: A Game of Incomplete Information



offender's beliefs about the victim's type be formed by the concept of passive conjectures.<sup>11</sup> This means that whenever the offender observes  $IS_c$  or  $IS_{dc}$ , he believes that the victim is strong with  $Prob(STRONG) = \gamma$ , and that the victim is weak with  $Prob(WEAK) = 1 - \gamma$ . Armed with these assumptions and concepts, the conditions for the following equilibria can be derived.

**Lemma 1:** *If and only if  $\gamma \geq \frac{\Pi}{R_O}$ , there exists a unique perfect Bayesian pooling equilibrium in which the victim chooses "complain" regardless of its own type and the offender chooses "comply".*

Proof: Given the game arrives at  $IS_c$ , the offender chooses "comply" if and only if its expected payoff from doing so is greater than or equal to its expected payoff from "don't

<sup>11</sup>The concept of passive conjectures assumes that the uninformed player (here the offender) uses the commonly known probabilities for the realization of each type (here  $\gamma$  and  $1 - \gamma$ ) to form its beliefs whenever an out-of-equilibrium action is observed. See Rasmusen (2001)[18] for a discussion of this concept.

comply”. Since

$$\begin{aligned}
E(\text{comply}|IS_c) &= \text{Prob}(a|IS_c)0 + \text{Prob}(b|IS_c)0 \\
&= \frac{\gamma}{\gamma + (1 - \gamma)}0 + \frac{1 - \gamma}{\gamma + (1 - \gamma)}0 \\
&= 0
\end{aligned}$$

and

$$\begin{aligned}
E(\text{don't comply}|IS_c) &= \text{Prob}(a|IS_c)(\Pi - R_O) + \text{Prob}(b|IS_c)\Pi \\
&= \frac{\gamma}{\gamma + (1 - \gamma)}(\Pi - R_O) + \frac{1 - \gamma}{\gamma + (1 - \gamma)}\Pi \\
&= \Pi - \gamma R_O
\end{aligned}$$

, “comply” is a best response for the offender if and only if  $\gamma \geq \frac{\Pi}{R_O}$ . Whenever this condition is satisfied, “complain” becomes a best response for victims of both types, yielding a payoff of  $-C$  which is greater than  $-D$ , being the payoff of “don’t comply”.<sup>12</sup>

This result states that it pays for a weak victim to act as if it were a strong victim if the offender believes that the probability for the victim being of strong type is sufficiently large (i.e.  $\gamma \geq \frac{\Pi}{R_O}$ ) or the damage inflicted by retaliation is sufficiently large (i.e.  $R_O \geq \frac{\Pi}{\gamma}$ ) or the gain from the offense is sufficiently small (i.e.  $\Pi \leq \gamma R_O$ ). But what happens in equilibrium if it is quite obvious for the offender that the victim is weak (i.e.  $\gamma < \frac{\Pi}{R_O}$ ) or that the victim does not have that much retaliatory power compared to the gains from the offense (i.e. a low  $R_O$  compared to  $\Pi$ )?

**Lemma 2:** *If and only if  $\gamma < \frac{\Pi}{R_O}$  and  $R_V \leq C$ , there exists a unique perfect Bayesian pooling equilibrium in which the victim chooses “don’t complain” regardless of its own type, and the offender chooses “don’t comply”.*

Proof: Given the game arrives at  $IS_c$ , the offender chooses “don’t comply” if and only if its expected payoff from doing so is greater than its expected payoff from “comply”. The proof

---

<sup>12</sup>The proof of uniqueness is found in the Appendix.

of Lemma 1 shows that  $E(\text{comply}|IS_c) = 0$  and  $E(\text{don't comply}|IS_c) = \Pi - \gamma R_O$ . Hence, “don’t comply” is a best response for the offender if and only if  $\gamma < \frac{\Pi}{R_O}$ . Whenever this condition is satisfied, “don’t complain” becomes a best response for victims of both types if  $R_V \leq C$ .<sup>13</sup>

The intuition of Lemma 2, as opposed to Lemma 1, is that once the probability of facing a strong victim lies below a certain level, the offender does not comply. In anticipation of this non-compliance, all victims are deterred from complaining since it does not even pay for a strong victim to complain against a non-complying offender by assumption (i.e.  $R_V \leq C$ ). So one may conjecture that once this assumption is changed, such that retaliation is profitable for strong victims (i.e.  $R_V > C$ ), while it still does not pay for a weak victim to disguise as a strong victim (i.e.  $\gamma < \frac{\Pi}{R_O}$  still holds), the game may exhibit an intuitive separating equilibrium with strong victims complaining and weak victims not complaining. However, this is not true since the offender believes that he faces a strong victim, once he observes a complaint. Consequently the offender will switch to “comply” in order to avoid retaliation. But then in turn even weak victims would complain. Hence the game has no equilibrium in pure strategies at all under the assumptions  $R_V > C$  and  $\gamma < \frac{\Pi}{R_O}$ .

**Proposition 2:** *In a game of incomplete information, where a strong victim benefits from retaliation and a weak victim does not benefit from retaliation and where only the victim knows its own type, a victim which is suffering from the infringement of a bilateral trade agreement would be expected to file a complaint if*

- (i) *the offender’s loss due to retaliation  $R_O$  is large (Lemma 1 and 2)*
- (ii) *the offender’s gain from the offense  $\Pi$  is small (Lemma 1 and 2)*
- (iii) *the victim’s gain from retaliation  $R_V$  is large (Lemma 2)*
- (iv) *litigation costs  $C$  are low (Lemma 2)*
- (v) *the victim’s damage  $D$  exceeds litigation costs  $C$  (condition (3) and (4)).*

---

<sup>13</sup>The proof of uniqueness is found in the Appendix.

## 2.3 Intermediate Results

Proposition 1 shows that under complete information more complaints should be observed if the victim can reap substantial gains from retaliation, while the offender suffers from it.

Proposition 2 suggests that under the alternative assumption of asymmetric information,  $\Pi$  and  $R_O$  are as well crucial in determining whether in equilibrium countries do or do not complain. In particular whenever an offender believes that, all other things equal, the victim has a large retaliatory capacity (e.g. if the victim is a major importer of the offender's goods), this victim is more likely to end up as a complainant, as opposed to a victim that has a small retaliatory capacity as perceived by the offender.

Since the non-complaining equilibrium of Lemma 2 requires the additional assumption of  $R_V \leq C$ , victim countries that do have the possibility to extract substantial welfare gains from retaliation are more likely to end up as complainants.

Finally, under complete as well as under asymmetric information the “value” of the dispute has to be large enough to cover litigation costs in order to make a complaint profitable at all. Hence  $D > C$  is an overall necessary condition to observe any complaints at all, taking into account the WTO's equivalence condition of Assumption 1 (i.e.  $R_V \leq D$ ).

In light of the central question, which country specific and dispute specific factors determine whether a country complains or not, the list of suspicious variables can be summarized as follows:<sup>14</sup>  $C(-)$ ,  $D(+)$ ,  $\Pi(-)$ ,  $R_O(+)$ ,  $R_V(+)$ .

## 3 Binary Decision Model

This section aims at empirically verifying the previously obtained theoretical results by means of a binary regression model. The setup of the general model and the selection of variables, disputes and countries is followed by a presentation of the data.

---

<sup>14</sup>A (+) behind a variable indicates that the variable is expected to increase a country's incentive to file a complaint, while a (-) behind a variable indicates that this variable is expected to decrease a country's incentive to file a complaint.

### 3.1 Setup of the Model

In order to explain the victim's binary complaining decision by the previously identified variables of the games, a nonlinear probit model will be employed.<sup>15</sup> Let the variable  $y_i$  represent the choice of the  $i$ th victim, which takes the value 1 if the victim files a complaint and 0 otherwise. Consider that a rational individual would prefer to complain, whenever doing so yields more utility than not complaining, but that these utility levels are unobservable. Let the  $i$ th victim's utility from complaining be denoted by  $U_{i1}$  while utility from not complaining is denoted by  $U_{i0}$ . Moreover, define  $y_i^* := U_{i1} - U_{i0}$ . Then it holds that

$$y_i = \begin{cases} 1 & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0. \end{cases} \quad (6)$$

Note that in equation 6,  $y_i$  apparently is observable as opposed to  $y_i^*$ . The insights from the dispute settlement games suggest that a particular victim's utility from complaining (i.e.  $U_{i1}$ ) and not complaining (i.e.  $U_{i0}$ ) be determined by a vector of exogenous and observable variables. Consequently  $y_i^*$  is as well determined by a vector of these exogenous variables. In particular, let

$$y_i^* := x_i' \beta + \varepsilon_i \quad (7)$$

, where  $x_i'$  denotes the vector of exogenous variables,  $\beta$  denotes the vector of unknown parameters and  $\varepsilon_i$  represents random errors. Furthermore let  $P_i$  denote the probability for  $y_i = 1$ , then  $1 - P_i$  is the probability for  $y_i = 0$ . Consequently it follows from equations (6) and (7) that

$$P_i = Prob(y_i = 1) = Prob(y_i^* > 0) = Prob(\varepsilon_i > -x_i' \beta). \quad (8)$$

Assuming a symmetric probability distribution, like the normal, it holds as well that

$$P_i = Prob(y_i = 1) = Prob(y_i^* > 0) = Prob(\varepsilon_i < x_i' \beta). \quad (9)$$

---

<sup>15</sup>For an extensive discussion of the nonlinear probit model see Greene (2003)[6], chapter 21 or Judge et. al (1988)[13], chapter 19.

Hence the probability for a complaint can be compactly written as

$$P_i = F(x_i'\beta) \tag{10}$$

, where  $F(\cdot)$  denotes the cumulative distribution function of the standard normal in case of the probit model.

### 3.2 Selection of Explanatory Variables

The variables of the game theoretic model are generally unobservable in reality. In order to be able to empirically test the theory's predictions, it is necessary to find observable data that can be employed as a proxy for each of those theory variables that have been identified as being crucial for determining a country's decision whether or not to complain.

#### How to Proxy for Litigations Costs

The victim's costs of litigation may contain various elements. One task in the course of the preparation of a complaint is to collect data on the scope of the infringement. Another one is to calculate the precise monetary value of the injury, using plausible price elasticities that need to be estimated in advance. In order to conduct these kinds of economic assessments, the trade mission of the victim country would either have to hire consultancies that are specialized in this field, or it would have to exploit the working capacity of the trade mission's permanent employees. In addition to these economic calculations the complaint needs to be prepared by lawyers that know the particular legal aspects of the GATT/WTO agreement. Finally, in a lengthy dispute there will be traveling costs for several flights, hotel stays, etc. Nordström (2005)[17] emphasizes the role that litigation costs play in deterring especially smaller countries from using the dispute settlement system. Nordström reports that "*[t]he fees charged by top-notch law firms in Brussels and Washington D.C. are in the range of \$500 to \$1.000 per hour plus expenses [...]*".<sup>16</sup> Moreover, he "*[...] find[s] that the legal fees may add up to several thousand dollars even for relatively simple cases [...]*".<sup>17</sup> Bown & Hoekman (2005)[3] report similar figures. In line with Nordström's findings it may be assumed that

---

<sup>16</sup>Nordström (2005)[17], page 1.

<sup>17</sup>Ibid.

the level of litigation costs rises with the complexity of a case but that it is independent of the value of the traded goods at stake in a particular dispute.

One argument that could be made to tie the level of litigation costs to a country specific variable is as follows. It may be the fact that richer countries' governments already sunk a significant part of their litigation costs by running a large permanent trade mission in Geneva and having several trade economists and lawyers permanently on their payroll. As opposed to this, poorer countries that don't have a "standing army" of economists and lawyers may regard substantial parts of the litigation costs as variable costs. However, Bown (2005)[2], who uses data on the number of a country's delegates at the WTO Secretariat finds no evidence of such a potential influence on a country's decision whether or not to file a complaint. Guzman & Simmons (2005)[8] model the role of litigation costs as a problem of limited legal capacity. In particular, they assume that the larger a country is in terms of its GDP (in an alternative model they use the GDP per capita), the larger is the number of disputes this country can handle.

All in all, litigation costs may be either regarded as decreasing in the victim's GDP ( $GDP_V$ ) and the victim's GDP per capita ( $GDP_{PC_V}$ ), or they may be regarded as completely independent of these two variables. Furthermore, there is no theory which predicts that that a victim's litigation costs increase in its GDP or GDP per capita. Hence it may be expected that  $\frac{\partial C}{\partial GDP_V} \geq 0$  and  $\frac{\partial C}{\partial GDP_{PC_V}} \geq 0$ .

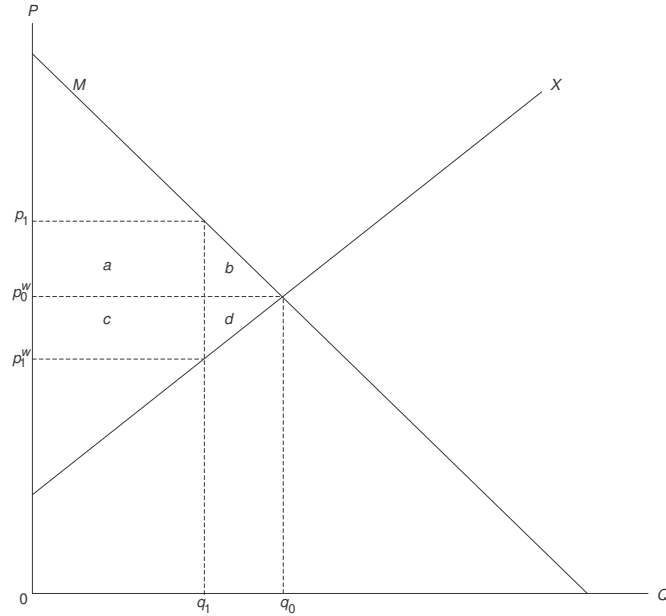
### **How to Proxy for Gains and Losses from Import Restrictions**

The game theoretic model includes two variables reflecting gains from import restrictions for the active country (i.e.  $\Pi$  and  $R_V$ ) and two variables reflecting losses from import restrictions for the passive country (i.e.  $D$  and  $R_O$ ).

There are two economic reasons for why a country may benefit from implementing an import restriction. First, countries may put more weight on the producer surplus of their domestic import substituting industries than on consumer surplus in the market for a particular commodity. The second argument applies only to those countries that are large enough to influence world market prices since these countries can influence the terms of trade in their favor such that they realize a net welfare gain from the imposition of an import barrier.

Figure 3 shows the effects of an import tariff, levied by a large country. The downward

Figure 3: Welfare Effects of an Import Tariff



sloping line  $M$  represents the country's import demand, and the upward sloping line  $X$  represents global export supply. Initially, when there is no tariff, the world market price  $p_0^w$  equals the domestic price  $p_0$ , while  $q_0$  indicates the initially traded quantity. Suppose that now the importing country levies a tariff of  $\tau$ . Then the domestic price rises to  $p_1$  and reduces import demand to a quantity of  $q_1$ . Since the global export supply is not completely elastic, the reduction in import demand leads to a reduction of the world market price to  $p_1^w$ . The effects on the welfare of the importing country are ambiguous. On the one hand, consumer surplus is reduced by the trapezoid area  $a + b$ . On the other hand, the country realizes a tariff revenue of the rectangular area  $a + c$ . So the net welfare gain for the importer is  $c - b$ .<sup>18</sup> Clearly this difference decreases as the global export supply gets more and more elastic. Finally, if the importer faced a completely elastic export supply, the area  $c$  would vanish, meaning that the complete tax plus the deadweight loss had to be borne by domestic consumers. Consequently a net welfare loss would be the result if the export supply were sufficiently elastic. Furthermore, the elasticity of the importing country's demand plays a

<sup>18</sup>Any increase of a potentially existing domestic import substituting producer's surplus is out of the scope of this analysis.

role as well. Consider the consequences of a less elastic (i.e. steeper) import demand curve on the net welfare gain  $c - b$ . Obviously  $b$  would increase when holding  $c$  fixed or, vice versa  $c$  would shrink when holding  $b$  fixed, so that the net welfare gain would decrease.

The bottom line message from this little exercise is, that bigger countries are more likely to be able to extract a large gain (i.e. large  $\Pi$  or  $R_V$ ) from imposing an import restriction because (i) bigger countries usually have more elastic import demand since they are more likely to produce domestic substitutes and (ii) bigger countries are more likely to be able to influence world market prices and consequently face a less elastic export supply. In a theoretical analysis, Anderson (2002)[1] emphasizes these difficulties that are predominantly faced by smaller countries which consider the implementation of retaliatory measures. Broda et. al. (2006)[4] found some evidence that is mirroring this result in the data. In an empirical study they are able to show that countries seem to take the relevant elasticities into account when setting their tariffs. Thus it can be concluded that  $\frac{\partial \Pi}{\partial GDP_O} > 0$  and  $\frac{\partial R_V}{\partial GDP_V} > 0$ . For the case of the gains from retaliation (i.e.  $R_V$ ) two additional things play a crucial role. First, the value of the victim's imports from the offender (if it imports anything from the offender at all) constitutes an upper bound for the implementation of retaliation since retaliation can apparently only target these imports. Hence, for the trade value of the exports from the offender to the victim ( $X_{OV}$ ) it should hold that  $\frac{\partial R_V}{\partial X_{OV}} > 0$ . Second, since the WTO's equivalence condition authorizes retaliation up to the magnitude of the initial damage, the trade value of the disputed commodities (DTV) limits the extent of retaliation as well. Hence, it may be conjectured that  $\frac{\partial R_V}{\partial DTV} > 0$ .

What is left to be analyzed, are the detrimental effects of an (retaliatory) import restriction on the passive country. The magnitude of the initial damage  $D$  clearly depends on the trade value of the disputed commodity. Hence it seems likely that  $\frac{\partial D}{\partial DTV} > 0$ . Furthermore, as previously stated, the extent of retaliation is apparently limited by  $X_{OV}$  and by  $DTV$  due to the equivalence condition. Thus it can be expected to hold that  $\frac{\partial R_O}{\partial DTV} > 0$  and  $\frac{\partial R_O}{\partial X_{OV}} > 0$ .

### Intermediate Results

As a summary, a country is expected to benefit the more from levying an import tariff, the larger it is and to suffer the more from an import tariff which targets its own exports, the smaller it is. Moreover, the extent of retaliation is limited by the total amount of exports

from the offender to the victim, and it is limited by the amount authorized by the WTO according to the equivalence condition. Litigation costs are expected to be either independent of country and dispute characteristics or to be decreasing in the economic size of a country. By applying these conclusions to the insights of the dispute settlement game, a link between observable variables of disputes and countries on the one hand and the expected behavior of a victim country on the other hand can be established. In particular, the probability for observing that an injured country files a complaint is given by  $P_i = F(x'_i\beta)$ , where  $x'$  incorporates those exogenous variables that have been found to be crucial for a countries decision earlier in this subsection (i.e.  $GDP_O$ ,  $GDP_V$ ,  $DTV$ ,  $X_{OV}$ ). Putting together the insights of the game from section 2 and this subsection's discussion on proxies for the game theoretic variables, it is possible to hypothesize on the links between the observable (continuous) exogenous variables and the observable (binary) endogenous variable in the following way.

$$\begin{aligned}
\text{(i)} \quad \frac{\partial P_i}{\partial GDP_O} &= \frac{\overbrace{\frac{\partial P_i}{\partial \Pi}}^{(-)} \overbrace{\frac{\partial \Pi}{\partial GDP_O}}^{(+)}}{\partial \Pi \partial GDP_O} < 0 \\
\text{(ii)} \quad \frac{\partial P_i}{\partial GDP_V} &= \frac{\overbrace{\frac{\partial P_i}{\partial R_V}}^{(+)} \overbrace{\frac{\partial R_V}{\partial GDP_V}}^{(+)}}{\partial R_V \partial GDP_V} + \frac{\overbrace{\frac{\partial P_i}{\partial C}}^{(-)} \overbrace{\frac{\partial C}{\partial GDP_V}}^{(-)}}{\partial C \partial GDP_V} > 0 \\
\text{(iii)} \quad \frac{\partial P_i}{\partial DTV} &= \frac{\overbrace{\frac{\partial P_i}{\partial D}}^{(+)} \overbrace{\frac{\partial D}{\partial DTV}}^{(+)}}{\partial D \partial DTV} + \frac{\overbrace{\frac{\partial P_i}{\partial \Pi}}^{(-)} \overbrace{\frac{\partial \Pi}{\partial DTV}}^{(+)}}{\partial \Pi \partial DTV} + \frac{\overbrace{\frac{\partial P_i}{\partial R_O}}^{(+)} \overbrace{\frac{\partial R_O}{\partial DTV}}^{(+)}}{\partial R_O \partial DTV} + \frac{\overbrace{\frac{\partial P_i}{\partial R_V}}^{(+)} \overbrace{\frac{\partial R_V}{\partial DTV}}^{(+)}}{\partial R_V \partial DTV} \geq 0^{19} \\
\text{(iv)} \quad \frac{\partial P_i}{\partial X_{OV}} &= \frac{\overbrace{\frac{\partial P_i}{\partial R_O}}^{(+)} \overbrace{\frac{\partial R_O}{\partial X_{OV}}}^{(+)}}{\partial R_O \partial X_{OV}} + \frac{\overbrace{\frac{\partial P_i}{\partial R_V}}^{(+)} \overbrace{\frac{\partial R_V}{\partial X_{OV}}}^{(+)}}{\partial R_V \partial X_{OV}} > 0
\end{aligned}$$

<sup>19</sup>With regard to satisfaction of the intuitive overall necessary condition to file a complaint (which is  $D > C$ ),  $DTV$  clearly has a positive effect.

In the game of complete information  $DTV$  has an unambiguously positive effect on the satisfaction of condition (4) since it raises both  $D$  and  $R_V$ . However,  $DTV$  would have an ambiguous effect on the satisfaction of the necessary and sufficient condition (3) since it raises both  $R_O$  and  $\Pi$ . Since there are two necessary and sufficient conditions, a complaint would be observed if the one or the other condition were satisfied. Hence, with  $DTV$  influencing one of these two conditions ambiguously while clearly promoting the satisfaction of the other, it is assumed that  $DTV$  increases the probability of observing a complaint in the game of complete information.

In the game of incomplete information  $DTV$  has an ambiguous effect on the satisfaction of the sufficient condition (i.e.  $\gamma \geq \frac{\Pi}{R_O}$ ) which is needed to obtain the pooling equilibrium in "complain" postulated by Lemma 1. The second equilibrium that could arise in the game of incomplete information is the pooling equilibrium in "don't complain" which is postulated by Lemma 2. This equilibrium requires  $\gamma < \frac{\Pi}{R_O}$  **and**  $R_V \leq C$ . Since both conditions have to be satisfied in order to observe "don't complain" in equilibrium, a high level of  $DTV$  undermines the occurrence of this equilibrium by increasing  $R_V$ .

Thus,  $DTV$  can be assumed to increase the probability of observing a complaint by a victim.

## 4 Sample Selection

Both the variables of the game theoretic model and the suggestions for how to proxy for these, are based on the assumption that the initial offense has been any measure that adversely affects imports. As a consequence, the model so far may not be applied to disputes dealing with e.g. export subsidies or violations of intellectual property rights. Moreover, it is required that the bundle of affected commodities can be determined. Practically this means that only disputes, dealing with import restrictions will be included, where there is information available on the Harmonized System (HS) codes of the disputable commodities. This information is generally found in the WTO's case records, which are publicly available on the internet pages of the WTO.<sup>20</sup>

Furthermore, since the value of the bilateral trade flow of the disputable commodity is of major interest, the data for the particular HS codes has to be available for the selected disputes. The UN COMTRADE database provides data on the vast majority of all bilateral trade flows up to the year 2005. Trade flows from 2006 are not yet covered sufficiently.<sup>21</sup> As a consequence, disputes from 1995 through 2005 are included. From the total number of 335 disputes that have arisen in that period, 185 deal with import restrictions.<sup>22</sup> In several of these disputes there are multiple complainants, such that the number of countries complaining is 198.

### 4.1 Selection of Injured Countries

Clearly it is plausible to assume the 198 complainants have been injured by the 185 offenses, but who else suffered from these offenses and did not complain? There is no certain answer to this question because for most cases there is virtually no information on the "dark figure" of victims available. However, given a sample in which the distinction between those countries that did not complain although they suffered on the one hand and those countries that did neither suffer nor complain on the other hand is known with certainty, it is possible to shed some light on the dark figure by means of statistic inference. Therefore, the remainder of

---

<sup>20</sup>In some cases, for which the WTO does not provide the HS codes, this information has been taken from Horn & Mavroidis (2006)[10], who provide a comprehensive database on disputes from 1995 through early 2004.

<sup>21</sup>As of July 14<sup>th</sup> 2007, the share of world trade in 2006 that is not yet available on UN COMTRADE is 36.3%. See <http://comtrade.un.org/db/>.

<sup>22</sup>See Appendix for a list of these disputes.

this subsection will suggest a procedure how to judge a country to be a victim of a particular import restriction.

### **Necessary Condition**

First, only those countries that have been a member of the WTO in the year of the dispute have been entitled to file a complaint in the first place. Second, only those WTO members will be considered to have suffered from an offense, which imported the disputable commodity into the offending country either in the year of the dispute or in the year before the dispute.<sup>23</sup>

### **Sufficient Condition**

One possibility to reason whether one of the countries that already satisfy the necessary condition has been affected by an offense, is to look for “suspicious” variations in the trade flow of the disputable commodity. Common sense would suggest that, all else being equal, the implementation of an import barrier should lead to a reduction in trade flows in the year of the dispute (or the year before the dispute) compared to the average trade flows of the previous years.

In order to derive an appropriate sufficient condition that is based on a variation in trade flows, data from Bown (2005)[2] is being exploited in the following way. There are 19 cases dealing with import restrictions in Bown (2005)[2], where not all trading partners of the disputable commodity have been affected by the offense of the respondent. For these 19 cases, the author succeeds in identifying those trading partners that have suffered from the offense.<sup>24</sup> In the next step, this list of injured but non-complaining trading partners of the 19 offenders, is augmented by all non-complaining trading partners who exported the particular commodity to the 19 offenders. When comparing the non-injured non-complaining trading partners to the injured non-complaining trading partners, it becomes apparent that

---

<sup>23</sup>The disputable commodity is specified with a precision of four digits according to the HS classification system. Note that most import restrictions specify the targeted commodities with a precision of four digits. Consequently the WTO’s case records as well as the database of Horn & Mavroidis (2006)[10] is dominated by four digit HS precision. Moreover, especially for many lower middle and low income countries, four digits is the highest degree of precision for most bilateral trade flows.

<sup>24</sup>I am grateful to Chad Bown who was so kind to send me data on the countries which have suffered from the 19 offenses, that Bown (2005)[2], page 9 describes as follows. “[...] 19 WTO-inconsistent policies in the sample were applied on at least a ‘quasi’-MFN basis, in that even though an MFN-violation is a key element of the dispute, we were still able to identify from other, non-WTO sources the other exporting countries in addition to the complainant facing the discrimination of the WTO-inconsistent policy.”

indeed the exports of the injured countries exhibit a dip, as opposed to the exports of the non-injured countries. Hence a criterion, based on this observation may be used in order to distinguish between injured and non-injured countries. In order to avoid distortions arising from variations in output levels, let the criterion be based on the relative share of exports of the disputable commodity that are shipped from the  $i$ th potential victim to the offender at time  $t$ , where  $t$  denotes the year of the dispute. Let  $TV_t^{io}$  denote the  $i$ th potential victim's exports to the offender at time  $t$ , and let  $TV_t^{iw}$  denote the  $i$ th potential victim's exports to the world at time  $t$ . Then the share of exports that is shipped from the  $i$ th victim to the offender at time  $t$  is simply

$$S_t^i := \frac{TV_t^{io}}{TV_t^{iw}}. \quad (11)$$

Consequently, the average share of exports that have been shipped from the  $i$ th victim to the offender from time  $t - k$  until time  $t - l$ , with  $k > l$  is

$$\mu_{kl}^i := \frac{1}{k - l + 1} \sum_{j=l}^k S_{t-j}^i. \quad (12)$$

Building on this, let the criterion be defined as the share of exports at time  $t$  over the average share of exports from  $t - k$  to  $t - 2$ .<sup>25</sup> Hence the criterion  $\Phi_k^i$  is

$$\Phi_k^i := \frac{S_t^i}{\mu_{k2}^i}. \quad (13)$$

The sample's distributional properties of the two alternative criteria  $\Phi_3^i$  and  $\Phi_4^i$  are displayed in Table 2. For  $\Phi_3^i$  the number of injured (non-injured) countries is 56 (247). For  $\Phi_4^i$  the number of injured (non-injured) countries is 44 (196).<sup>26</sup> Table 2 shows that injured countries exhibit lower values of both alternative criteria than non-injured countries. A test for different means of  $\Phi_3^i$  and  $\Phi_4^i$  in the two subsamples unambiguously rejects the Null

---

<sup>25</sup>The trade flows in the year before the official filing of the complaint (i.e.  $t - 1$ ) may already be affected by the offense. To avoid complications that could arise due to the potential endogenous character of the trade flow in  $t - 1$ , this period is being omitted.

<sup>26</sup>This difference in the number of observations is due to the fact that the  $\Phi_k^i$  criteria require the availability of bilateral trade data with a precision of four digits for several consecutive years. While  $\Phi_3^i$  requires data for only three years (i.e.  $t$ ,  $t - 2$  and  $t - 3$ ),  $\Phi_4^i$  requires data for four years (i.e.  $t$ ,  $t - 2$ ,  $t - 3$  and  $t - 4$ ).

Subsample Criterion	injured countries		non-injured countries	
	$\Phi_3^i$	$\Phi_4^i$	$\Phi_3^i$	$\Phi_4^i$
Mean	1.004962804	1.001819577	2.733825779	1.675199294
Std. Dev.	0.446674356	0.632216268	10.10916218	2.66398746
Observations	44		196	

Table 2: Distribution of Selection Criteria in the Sample

hypothesis of a common mean.<sup>27</sup> Thus, the criteria may serve to select injured countries from the population of those countries that already satisfy the necessary condition for being injured. In particular, the approach taken here defines a cut-off level for  $\Phi_4^i$ , so that all countries which exhibit a  $\Phi_4^i$  below this cut-off level will be judged as injured.<sup>28</sup> To formalize the cut-off level, let  $\mu_1$  and  $\sigma_1$  denote the mean and the standard deviation of  $\Phi_4^i$  in the subsample of injured countries, respectively. Moreover, let  $\alpha$  denote the the probability of an alpha error, i.e. erroneously judging an injured country to be non-injured.<sup>29</sup> Then the cut-off level is denoted by

$$\Phi_4^{cut}(\alpha) := z_{1-\alpha}(\mu_1, \sigma_1) \quad (14)$$

, where  $z(\cdot)$  denotes the  $\alpha$  quantile of a normal distribution with mean  $\mu_1$  and standard deviation  $\sigma_1$ . Finally, the selection of countries is conducted according to Assumption 2.

**Assumption 2:** *A country  $i$ , which satisfies the necessary conditions for being injured, is assumed to have suffered from an offender's disputable trade measure if and only if*

$$\Phi_4^i \leq \Phi_4^{cut}(\alpha). \quad (15)$$

<sup>27</sup>The hypotheses are  $H_0 : \mu_1 - \mu_2 = 0$  vs.  $H_1 : \mu_1 - \mu_2 \neq 0$ , where  $\mu_1$  represents a criterion's mean in the subsample of injured countries and  $\mu_2$  represents a criterion's mean in the subsample of non-injured countries. Furthermore let  $D$  be the difference of the subsample means. It follows that  $D(\Phi_3^i) = 1.728862975$  and  $D(\Phi_4^i) = 0.673370718$ . Using a pooled standard deviation  $s$ , the test statistic  $\Theta = \frac{D}{s}$  is asymptotically normal distributed. In particular  $\Theta_{\Phi_3^i} = 2.670699463$  and  $\Theta_{\Phi_4^i} = 3.150306819$ . Hence the Null hypothesis can be rejected for both criteria on all reasonable significance levels (i.e. 10%, 5% and 1% in a two-sided test).

<sup>28</sup>The test for different means suggests that  $\Phi_4^i$  is slightly more powerful than  $\Phi_3^i$  for distinguishing between injured and non-injured countries. A disadvantage of  $\Phi_4^i$  as opposed to  $\Phi_3^i$  clearly is the more excessive data requirement and its implications for a sample selection bias. However, the section dealing with the robustness of the results shows that whether  $\Phi_3^i$  or  $\Phi_4^i$  is employed, does not change the results qualitatively.

<sup>29</sup>The trade-off between alpha and beta error as well as the rationale for preferring to have a low alpha error in this criterion are discussed in the Appendix.

## 4.2 The Data

Selecting injured countries according to the rules of the previous subsection produces 2,409 injured countries when applying  $\Phi_4^{cut}(0.05)$ .<sup>30</sup> Among these injured countries there are 195 countries that filed a complaint.<sup>31</sup> For this sample, a data set of exogenous variables is compiled. The data set includes the “primary” variables  $DTV$ ,  $GDP_O$ ,  $GDP_V$  and  $X_{OV}$ . Moreover, as “secondary” variables, the offender’s and victim’s GDP per capita as well as an index of economic freedom are included in the data set in order to employ these for robustness checks in a later subsection.

- $DTV$  denotes the trade value of the exports of the disputable commodity with a precision of four digits according to the Harmonized System classification that are shipped from the victim to the offender in the year before the complaint in US Dollars.<sup>32</sup> Information on the HS codes is taken from the WTO’s “Documents Online”<sup>33</sup> internet page or from Horn & Mavroidis (2006)[10]. Bilateral trade values are taken from UN COMTRADE<sup>34</sup>.
- $GDP_O$  denotes the gross domestic product of the offender in the year of the complaint in US Dollars. Data on this variable is taken from the World Bank.
- $GDP_{PC_O}$  denotes the gross domestic product of the offender in the year of the complaint in US Dollars. Data on this variable is taken from the World Bank.
- $GDP_V$  denotes the gross domestic product of the victim in the year of the complaint in US Dollars. Data on this variable is taken from the World Bank.
- $GDP_{PC_V}$  denotes the gross domestic product per capita of the victim in the year of the complaint. Data on this variable is taken from the World Bank.

---

<sup>30</sup>The results do not change qualitatively when  $k = 3$  and/or other levels for the alpha error are employed, as the subsection on robustness shows. Hence it is an arbitrary decision, which one of the criteria is chosen. The remainder of the paper refers to the sample compiled by  $\Phi_4^{cut}(0.05)$ .

<sup>31</sup>Note that the earlier number of 198 complaining countries has been reduced by the number of three. This is due to the unavailability of trade data for the Dominican Republic who is a defendant in disputes 300, 302 and 333. Thus  $X_{OV}$  is not available for these three disputes.

<sup>32</sup>Since this variable should capture the amount of goods targeted, it is plausible to use the trade value at  $t - 1$  in order to deal with the problem that the disputable trade measure may have already reduced the trade value at time  $t$ .

<sup>33</sup>See <http://docsonline.wto.org/>.

<sup>34</sup>See <http://comtrade.un.org/db/>.

- $X_{OV}$  denotes the trade value of all exports that are shipped from the offender to the victim in the year before the complaint.<sup>35</sup> Data on this variable is taken from UN COMTRADE.
- $EF_V$  denotes the index of economic freedom for the victim in the year of the complaint.<sup>36</sup>

Table 3 reports mean and standard deviation for these variables separately for complaining and non-complaining countries selected according to  $\Phi_4^{cut}(0.05)$ . Table 3 already shows that

Subsample Variable\Variable	complaining		non-complaining		all	
	mean	std. dev.	mean	std. dev.	mean	std. dev.
$DTV$	9.04E+8	2.78E+9	2.29E+8	1.10E+9	2.84E+8	1.33E+9
$GDP_O$	4.76E+12	4.47E+12	6.95E+12	4.17E+12	6.78E+12	4.23E+12
$GDP_{PC_O}$	18,337	12,890	24,620	11,623	24,111	11.852
$GDP_V$	3.64E+12	4.27E+12	8.12E+11	2.26E+12	1.04E+12	2.60E+12
$GDP_{PC_V}$	16,071	13,016	11,346	12,238	11,729	12,367
$X_{OV}$	4.07E+10	6.03E+10	1.20E+10	2.98E+10	1.43E+10	3.42E+10
$EF_V$	67.56	9.18	65.76	10.63	65.91	10.53
Observations	195		2,214		2,409	

Table 3: Descriptive Statistics of Exogenous Variables

the previous theoretical considerations regarding the primary variables show up in the data at least on the basis of a comparison of conditional means. In particular, complaining victims exhibit higher trade values of the disputable commodity than non-complaining victims on average (i.e. USD 9.04E+8 > USD 2.29E+8). Moreover, complaining victims exhibit a higher GDP than non-complaining victims (i.e. USD 3.64E+12 > USD 8.12E+11) on average. The retaliatory capacity, measured by  $X_{OV}$ , shows that complaining victims feature a higher level of this variable than non-complaining victims (i.e. USD 4.07E+10 > USD 1.20E+10) on average. The offender's economic power, measured by  $GDP_O$ , exhibits a lower level in those cases where a victim filed a complaint as opposed to those cases where a victim did not file a complaint (i.e. USD 4.76E+12 < USD 6.95E+12) on average. Table 4 shows the correlation of the employed variables. Most values' signs and magnitudes are in line

<sup>35</sup>It may be the case that the aggregated bilateral trade flow has already been affected by the trade dispute in the year of the filing of the complaint. To avoid this potential endogeneity problem, the trade flow at time  $t - 1$  is used.

<sup>36</sup>The index of economic freedom used here, is taken from the Heritage Foundation (2006)[16]. Missing data on particular countries is augmented by decoupling the index of economic freedom provided by the Fraser Institute (2006)[9]. The index is scaled between 0 and 100 with 100 indicating the highest degree of economic freedom and zero indicating the lowest degree of economic freedom.

Variable	<i>DTV</i>	<i>GDP<sub>O</sub></i>	<i>GDPPC<sub>O</sub></i>	<i>GDP<sub>V</sub></i>	<i>GDPPC<sub>V</sub></i>	<i>X<sub>OV</sub></i>	<i>EF<sub>V</sub></i>
<i>DTV</i>	1	0.0643	0.0777	0.1696	0.1506	0.3623	0.1088
<i>GDP<sub>O</sub></i>		1	0.8415	-0.2515	-0.1542	0.1709	-0.1665
<i>GDPPC<sub>O</sub></i>			1	-0.2259	-0.1317	0.1665	-0.1191
<i>GDP<sub>V</sub></i>				1	0.4867	0.4690	0.2161
<i>GDPPC<sub>V</sub></i>					1	0.3637	0.6484
<i>X<sub>OV</sub></i>						1	0.1998
<i>EF<sub>V</sub></i>							1

Table 4: Correlation Matrix of Exogenous Variables

with intuition e.g. that *GDP<sub>O</sub>* exhibits a strong positive correlation with *GDPPC<sub>O</sub>* or that *GDPPC<sub>V</sub>* shows a strong positive correlation with *EF<sub>V</sub>*. Much more noteworthy is the finding that all GDP based variables of the offender are negatively correlated with the GDP based variables of the victims. In a sense, this underpins the results of Guzman & Simmons (2005)[8] that opposing parties tend to be rather of unequal size than of equal size in terms of their GDP. However, the finding here holds for all victims, whereas the finding of Guzman & Simmons refers to the subset of complaining victims.

The data set presented so far is being analyzed by means of a probit model subsequently.

## 5 Estimation and Results

Treating all observations as being individual (e.g. the US complaining in 1995 is a different victim than the US complaining in 1996), there are no repeated observations available. So the reaction of one and the same individual in more than one environment of explanatory variables does not occur.

The estimation method will therefore require the maximization of the likelihood function, which is  $\ell = \prod_{i=1}^T f(y_i) = \prod_{i=1}^T F(x'_i\beta)^{y_i} [1 - F(x'_i\beta)]^{(1-y_i)}$ , where  $F(\cdot)$  is again the cumulative distribution function of the normal distribution. After taking the logarithm, the function becomes  $\ln\ell = \sum_{i=1}^T y_i \ln F(x'_i\beta) + \sum_{i=1}^T (1 - y_i) \ln[1 - F(x'_i\beta)]$ . The maximization of this function via  $\beta$  is conducted using the numerical iterative Newton-Raphson method, which guarantees the convergence to the global maximum of the function.<sup>37</sup> The alternative maximization algorithm method of Quadratic Hill Climbing as well as the Gauss-Newton al-

<sup>37</sup>See Greene (2003)[6], page 670 ff. for a more detailed description of the properties of the Newton-Raphson estimation method.

gorithm confirm the results of the Newton-Raphson algorithm by producing similar results.<sup>38</sup>

Table 5 presents the results of five different probit regressions, where  $y$  is regressed on a vector of the previously introduced exogenous variables. The underlying sample selection criterion is  $\Phi_4^{cut}(0.05)$ , yielding 2,409 observations (195 complaining and 2,214 non-complaining victims). Standard errors are computed according to Huber/White (quasi maximum likelihood), while \*, \*\* and \*\*\* indicate a variable's significance on a ten, five and one percent level respectively.<sup>39</sup>

Variable	Model 1	Model 2	Model 3a	Model 3b	Model 4
$C$	-1.3855***	-1.2927***	-1.1072***	-1.2903***	-1.7085***
$GDP_O$	-4.01E-14***	-6.40E-14***	-8.51E-14***	-6.42E-14***	
$GDP_V$	1.11E-13***	7.11E-14***		7.19E-14***	
$DTV$	8.50E-11***	5.11E-11**			5.30E-11**
$X_{OV}$		5.99E-12***	9.73E-12***	6.65E-12***	7.16E-12***
$\frac{DTV}{GDP_V}$			1.9513	3.7117	
$\frac{GDP_O}{GDP_V}$					0.0548***
$(\frac{GDP_O}{GDP_V})^2$					-0.0004***
McFadden $R^2$	0.1239	0.1451	0.1215	0.1416	0.1316
Akaike	0.4958	0.4848	0.4972	0.4867	0.4923
Schwarz	0.5055	0.4968	0.5068	0.4987	0.5043
Hannan-Quinn	0.4993	0.4891	0.5007	0.4911	0.4967

Table 5: Probit Results for Level Data under  $\Phi_4^{cut}(0.05)$

**Model 1** shows that the estimated coefficients of a regression of  $y$  on a constant, both GDPs and the disputable trade value are in line with the earlier predictions from theory. In particular, a victim is more likely to file a complaint if it is large in terms of GDP, if the offender is small in terms of GDP, and if the disputable trade value is large. All coefficients are significant at the one percent level.

**Model 2** augments Model 1 by adding the aggregated export flow from the offender to the victim as a proxy for the victim's retaliatory capacity. While  $X_{OV}$  exhibits the predicted positive sign, the significance level of  $DTV$  deteriorates slightly due to a high degree of positive correlation between  $X_{OV}$  and  $DTV$ .<sup>40</sup> Still the explanatory power of each variable

<sup>38</sup>The software used for the estimation of the following models is EViews 5.0.

<sup>39</sup>Employing other computational concepts of standard errors, such as generalized least squares, leads only to minor changes in the significance levels. The changes in significance are small enough to ensure that all \*, \*\* and \*\*\* notations remain valid for every variable in each of the five models.

<sup>40</sup>The z-Statistic of  $DTV$  falls from 3.9096 to 2.2095 in the course of the introduction of  $X_{OV}$ . The generalized least squares regression of  $DTV$  on a constant and  $X_{OV}$ , i.e.  $DTV = \beta_0 + \beta_1 X_{OV} + \varepsilon$ , yields a positive value for  $\beta_1$  with a highly significant t-Statistic of 6.9774.

is large enough to maintain a five percent significance level even for the least significant variable.

**Model 3a and Model 3b** are based on the same data as Model 2, but they employ a relative measure of the disputable commodity by choosing  $\frac{DTV}{GDP_V}$  as a regressor. This is done in order to address the question whether the relative importance of a victim's targeted exports in terms of the victim's GDP may contribute to explaining a victim's incentive to file a complaint. The results of Table 5 basically turn this idea down by showing an insignificant coefficient, while leaving the other variables' signs and explanatory power unaffected.

**Model 4** elaborates on the idea of using the ratio of the victim's GDP to the offender's GDP as a regressor. The results show that a victim's relative economic size explains the choice between complaining and not complaining almost as good as the separate inclusion of each GDP in Model 2. Moreover, the negative sign of the squared GDP ratio indicates a positive and concave relationship between the GDP ratio and the probability to file a complaint.

All over the set, the results agree with the predictions of the stylized game theory in that a country's economic power promotes its incentive to file a complaint against an offending trading partner. In line with intuition, the results show that a high trade value of the targeted commodity increases a country's probability to file a complaint as well. Moreover, the economic power of the offending country is detrimental to the injured country's probability of using the dispute settlement system. This particular result means as well that economically large countries can freeride on their own size by committing infringements of trade agreements with small trading partners since the latter are likely to be deterred from filing a complaint in the first place. While all models' findings agree with the earlier presented theory, the McFadden  $R^2$  as well as the Akaike, Schwarz and Hannan-Quinn criteria consistently prefer Model 2 to the other four models.<sup>41</sup>

The insight from Model 3a and 3b, that the relative importance of the disputable trade value compared to the victim's GDP does not serve to explain the observed behavior, is in line with the game theoretic foundation. This is because the potential gain from complaining is tied to the trade value of the commodity at stake and not to some relative measure of it.

Once the potential gain of filing a complaint, which is approximated by  $DTV$ , falls short of

---

<sup>41</sup>Hence, Model 2 will be the benchmark model for further augmentation in the subsection on robustness.

the litigation costs  $C$ , there is no point in complaining at all. Of course, a victim's ability to enforce the offender's compliance, and therefore its ability to reap any gains from compliance, are dependent on the victim's economic power. However, a victim's ability to force an offender into compliance depends upon the victim's absolute threat of retaliation, which in turn depends positively upon the victim's size, positively upon its retaliatory capacity and, via the amount of authorized retaliation, positively upon the disputed trade value, but not upon the ratio of disputable trade value and GDP. As an example consider a victim  $i$  with a low  $GDP_V$  and  $DTV$  resulting in a particular  $\frac{DTV}{GDP_V}$ . This  $i$ th victim has a lower probability of filing a complaint than a victim  $j$  that exhibits just a ratio of  $\frac{DTV}{GDP_V} \leq \frac{DTV}{GDP_V}$  if this  $j$ th victim is characterized by absolutely larger values of  $DTV$  and/or  $GDP_V$ . Since the export structure of many low and lower middle income countries is rather concentrated on e.g. a few agricultural goods, textiles, raw materials, and raw products, it can be conjectured that these countries are struck "hard" in terms of their GDP by any import barrier targeting their exports.<sup>42</sup> Nevertheless, as long as the absolute value of the targeted goods is not high enough to break even with litigation costs, and as long as such a victim cannot reap potential gains from retaliation, it is unlikely to file a complaint, both from the theoretical and the empirical perspective.

## 5.1 Robustness

The purpose of this subsection is to check whether the results obtained from the benchmark model of the previous chapter are robust to (i) augmenting the model by adding explanatory variables, (ii) employing the logarithm of the exogenous variables and (iii) conducting changes in the sample selection criterion.

### Additional Explanatory Variables

Table 6 shows that the estimated coefficients of the primary variables keep their sign and remain significant at least at five percent when the victim's index of economic freedom ( $X_{OV}$ ), the victim's GDP per capita ( $GDP_{PC_V}$ ) and the offender's GDP per capita ( $GDP_{PC_O}$ )

---

<sup>42</sup>Shaffer et. al. (2003)[7], page 15 express this observation in the following way: "Developing countries often have high per capita stakes in individual cases, so that WTO law can be of potential benefit to them. Overall, however, developing countries simply export a vastly narrower array and limited value and volume of exports than do the United States and EC."

are added to the benchmark model of Table 5.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$C$	-1.3855***	-1.2927***	-0.5241*	-1.040***	-0.9402**
$GDP_O$	-4.01E-14***	-6.40E-14***	-6.89E-14***	-6.90E-14***	-2.42E-14
$GDP_V$	1.11E-13***	7.11E-14***	7.65E-14***	1.00E-13***	9.97E-14***
$DTV$	8.50E-11***	5.11E-11**	5.37E-11**	5.64E-11**	5.90E-11**
$X_{OV}$		5.99E-12***	6.53E-12***	6.95E-12***	7.29E-12***
$EF_V$			-0.0115***	-0.001	-0.0008
$GDPPC_V$				-1.59E-5**	-1.66E-05**
$GDPPC_O$					-1.89E-06***
McFadden $R^2$	0.1239	0.1451	0.150329	0.1560	0.1625
Akaike	0.4958	0.4848	0.4826	0.4803	0.4774
Schwarz	0.5055	0.4968	0.4970	0.4971	0.4967
Hannan-Quinn	0.4993	0.4891	0.4878	0.4864	0.4844

Table 6: Probit Results for the Augmented Model under  $\Phi_4^{cut}(0.05)$

### Specification in Logarithms

Table 7 reports the estimated coefficients for the logarithms of the explanatory variables. Note that all results of the benchmark model prove to be robust to the specification in logarithms. There are no changes in sign nor any major changes in the significance levels. All signs and most significance levels are sustained as well if a constant is included into the logarithmic model.<sup>43</sup> Goodness-of-fit tests like the Hosmer-Lemeshow and the Andrews test even favor the log specification of Model 2 without constant to the level specification that is used in the benchmark model.

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$\log(GDP_O)$	-0.2243***	-0.2553***	-0.2037***	-0.2491***	-0.2528***
$\log(GDP_V)$	0.1104***	0.0804***	0.1421***	0.1467***	0.1473***
$\log(DTV)$	0.1271***	0.1078***	0.1056***	0.1067***	0.1068***
$\log(X_{OV})$		0.0910***	0.0659**	0.1043***	0.1037***
$\log(EF_V)$			-0.5996***	-0.2265	-0.2222
$\log(GDPPC_V)$				-0.1426***	-0.1429***
$\log(GDPPC_O)$					0.0090
Akaike	0.4677	0.4638	0.4604	0.4576	0.4584
Schwarz	0.4749	0.4734	0.4724	0.4720	0.4753
Hannan-Quinn	0.4703	0.4673	0.4648	0.4629	0.4646

Table 7: Probit Results for the Augmented Model in Logs under  $\Phi_4^{cut}(0.05)$

<sup>43</sup>See Table 11 in the Appendix.

### Alternative Sample Selection Criteria

Changes in the sample selection criterion  $\Phi_k^{cut}(\alpha)$  may affect both the initial year  $t - k$  of the calculated average and the level of the alpha error separately and jointly, for level data and for logarithmic data. The following Table 8 shows estimates for the coefficients of the benchmark Model 2 for different selection criteria, using level data. Table 12 analogously provides estimates for Model 2 with logarithmic data.<sup>44</sup> The leftmost column of both tables shows the estimates of the original benchmark model with  $k = 4$  and  $\alpha = 0.05$ , while the three remaining columns show the estimation results for different values of  $k$  and  $\alpha$ . Note that the number of observations, i.e. the number of countries classified as injured, varies with the changes in the selection criterion.

Variable\Criterion	$\Phi_4^{cut}(0.05)$	$\Phi_4^{cut}(0.1)$	$\Phi_3^{cut}(0.05)$	$\Phi_3^{cut}(0.1)$
$C$	-1.2927***	-1.2772***	-1.3544***	-1.332***
$GDP_O$	-6.40E-14***	-6.41E-14***	-6.14E-14***	-6.19E-14***
$GDP_V$	7.11E-14***	7.00E-14***	7.50E-14***	7.47E-14***
$DTV$	5.11E-11**	5.06E-11**	5.22E-11**	5.13E-11**
$X_{OV}$	5.99E-12***	6.00E-12***	6.01E-12***	6.00E-12***
McFadden $R^2$	0.1451	0.1436	0.1466	0.1465
Akaike	0.4848	0.4959	0.4586	0.4707
Schwarz	0.4968	0.5082	0.4699	0.4823
Hannan-Quinn	0.4891	0.5003	0.4627	0.4749
Observations	2,409	2,338	2,599	2,506

Table 8: Probit Results for Level Data under Various Sample Selection Criteria

Although the conducted alterations of the sample selection criterion do not change the main results of the regression, there are two points of criticism that should be mentioned.

First, consider the case where an offender infringes a trade agreement, but not even one single victim files a complaint. Clearly the offender and all victims of this infringement are not observed and not included into the analysis.<sup>45</sup> From what has been argued throughout this paper so far, it may be conjectured that these completely invisible violations are predominantly characterized by a large offender (in terms of  $GDP_O$ ) committing an offense that is not too severe (in terms of  $DTV$ ) against a bunch of small victims (in terms of  $GDP_V$ )

<sup>44</sup>See Table 12 in the Appendix.

<sup>45</sup>At present the author cannot imagine a method for making these cases visible.

which exhibit a low retaliatory capacity (in terms of  $X_{OV}$ ). Hence, the sample of victims that is used in this paper is likely to exhibit a systematic bias against country pairings with the just described properties.

Second, data availability is generally worse for poor countries than for rich countries. Hence, some of the poorest victims' trade flows may not be included in the COMTRADE database. Consequently, the previously described bias is growing even worse since victims with low  $GDP_V$  and low  $DTV$  are more likely to be missing in the database. However, this second concern is perhaps not as problematic as the first one, since it should reasonably be assumed that a victim which does not even keep track of its own trade flows, does not take notice of an infringement of a trade agreement. This monitoring problem of the smallest countries mitigates the bias since a victim can only make a conscious decision on whether to complain or not if it observes the offense at all. Furthermore, those smallest countries which do not take notice of a trading partner's offense against any of their exporters should not be included into the analysis, even if it were possible to do so. This is because the probit model aims at explaining deliberate decisions under the assumption of equal information for every victim. A (hypothetical) inclusion of the non-monitoring victims would cause an omitted variable bias since these victims would apparently never file a complaint. But they would do so because they exhibit the property of being unable to monitor their trade flows and not as a result of a careful decision making process like the other monitoring victims.

As a summary, it can be stated that all central results have proved to be robust to the conducted changes in variables, model specifications and sample selection criteria. Moreover, the approach presented here is unable to overcome the problem of identifying the victims of those infringements where not even a single country complained.

## 6 Extension: A Note on Guzman & Simmons (2005)

In their 2005 paper titled *Power Plays and Capacity Constraints: The Selection of Defendants in World Trade Organization Disputes*, Andrew Guzman and Beth Simmons investigate the relationship between an offender's GDP and a complaining victim's GDP. They argue that on the one hand, a victim of a given size would rather complain against offenders that are not larger than the victim itself because of "power" considerations. On the other hand,

a victim of a given size would utilize its legal capacity most efficiently if it complained in those cases where a high trade value is at stake. Since these latter cases are most likely to occur in a trading relation with a big country, a victim of given size would be expected to file complaints predominantly against bigger countries, according to Guzman & Simmons. Hence, the authors postulate two opposing hypotheses.<sup>46</sup>

**The Capacity Hypothesis.** As a country's income falls, a larger percentage of its complaints will be directed at High Income defendants.

**The Power Hypothesis.** As a country's political power falls, a larger percentage of its complaints will be directed at states with little political power.

In order to estimate the net effect of these two clashing hypotheses, Guzman & Simmons regress the logarithm of the offender's GDP ( $GDP_O$ ) on the logarithm of the complainant's GDP ( $GDP_V$ ) and several other exogenous control variables.

Based on 285 to 303 observations, Guzman & Simmons estimate six models with different subsets of explanatory variables using ordinary least squares. Their central result is that the relationship between the logarithm of both parties' GDP is negative. The authors conclude from this result that, all else equal and speaking in terms of GDP, smaller countries are more likely to complain against bigger countries than against countries of about the same size. Furthermore, they draw the conclusion that the capacity effect dominates the power effect.<sup>47</sup>

### **The Idea of Re-estimating the Guzman & Simmons Model**

From an economic perspective the Capacity Hypothesis exhibits a problem in itself in the light of the results of this paper's theory. A low endowment of legal resources can be understood as a high level of litigation costs. Hence, along the lines of Guzman & Simmons,

---

<sup>46</sup>The hypotheses are found at page 572 in Guzman & Simmons (2005)[8].

<sup>47</sup>Note that a negative coefficient for  $\log(GDP_V)$  in Guzman & Simmons' model means on the one hand that small countries complain against larger countries rather than against countries of about the same size. On the other hand, this result means as well that big countries would rather file a complaint against a smaller country than against a country of about the same size. Guzman & Simmons state on page 583: "*Although consistent with our results, we are unable to imagine a coherent theory under which poor states are prepared to file complaints against rich states but all else equal rich states are reluctant to do the same.*".

it could be conjectured that countries which are poor or small in terms of their GDP face a high level of litigation costs. In this paper it has been argued that the necessary condition to file a complaint is  $D > C$ . So if we are concerned that poor countries lack legal resources, we should be tempted to say that these countries will only engage infringements that cause a high damage which lets them break even with their high level of litigation costs.<sup>48</sup> In their argumentation, Guzman & Simmons speak of a “*large market*”<sup>49</sup>, but what they indeed use to control for the size of the affected market in their regression, is the GDP of the offender. Granted, the market size or the disputable trade value at stake is positively correlated with the offender’s GDP, but this correlation is very mild.<sup>50</sup> This is due to the fact that the *DTV* varies extremely across disputes.<sup>51</sup> So from this finding alone one could conjecture that the information that is incorporated in the trade value at stake may be close to orthogonal to the GDP of the offender. Consequently, the GDP does not serve as a reasonable proxy.

It would be an interesting question to ask whether the relationship between both parties’ GDPs would still be negative if one augmented a regression of the Guzman & Simmons fashion by the disputable trade value at stake. By doing so, it would be possible to distinguish between a victim’s incentive to complain against infringements of large markets on the one hand and its disincentive to mess with bigger countries on the other hand. From this paper’s insights, we would hypothesize that, all else equal, the GDP of an offender should be increasing in the disputable trade value and in the victim’s GDP. This is because a complaint against a big country is more likely to be profitable if the complainant and/or the trade value at stake are large. Equation 16 describes the regression approach, where the logarithm of the offender’s GDP ( $\log(GDP_O)$ ) is regressed on a constant ( $C$ ), the logarithm of the complaining victim’s GDP ( $\log(GDP_V)$ ), the logarithm of the disputable trade value ( $\log(DTV)$ ), a dummy that equals one if either the EC or the US are the offender ( $ECorUS_O$ ), a dummy that equals one if there are multiple complainants in a dispute ( $MC$ )

---

<sup>48</sup>On page 572 Guzman & Simmons (2005) argue analogously: “*All else equal, the capacity hypothesis suggests that a capacity-constrained state will be able to pursue only a limited number of cases. The state must prioritize the list of potential defendants and will tend to pursue larger markets rather than smaller markets. Thus, a low-capacity complainant may pursue only one case, and that case will be against a defendant with a large market.*”.

<sup>49</sup>See Guzman & Simmons (2005), page 572.

<sup>50</sup>Note Table 4 showing a rather low correlation coefficient between *DTV* and  $GDP_O$ .

<sup>51</sup>Note that Table 3 shows a mean of  $2.84E + 8$  and a standard deviation of  $1.33E + 9$  for *DTV*.

and a random disturbance term  $\varepsilon$ .

$$\log(GDP_O) = \alpha + \beta_1 \log(GDP_V) + \beta_2 \log(DTV) + \delta_1 ECORUSO + \delta_2 MC + \varepsilon \quad (16)$$

Equation 16 is estimated on the basis of the 198 disputes that satisfy the necessary condition of section 4, for which the vector of disputable trade values has already been compiled in the course of the earlier employed binary model of this paper. Using feasible general least squares and heteroscedasticity consistent standard errors, the following results are obtained.<sup>52</sup> Table

Variable	Coefficient
$C$	23.3059***
$\log(GDP_V)$	0.0804***
$\log(DTV)$	0.0422***
$ECORUSO$	3.4968***
$MC$	0.2398**
$R^2$	0.9969
Adjusted $R^2$	0.9968
Akaike	2.1779
Schwarz	2.2609
Observations	198

Table 9: Feasible General Least Squares Results for Equation 16

9 shows that the estimated coefficients for the victim's GDP as well as for the disputable trade value are positive and significant on a one percent level. This change in the sign of the coefficient for the victim's GDP means that, all else equal, small countries would rather complain against small countries than against large countries. In Guzman & Simmons' paper all else is not equal, since they do not control for the trade value at stake. Here the trade value at stake has been found to have a highly significant influence on a victim's decision whether to complain against an offender of a particular size. Hence it may be concluded that Guzman & Simmons' somewhat counterintuitive result is driven by the trade values at stake. Consequently, this paper objects to the conclusion that small countries prefer to complain against large countries.

<sup>52</sup>Again, the estimation is conducted using EViews 5.0.

## 7 Conclusion

This paper aimed at analyzing the question whether power considerations do bias the use of the DSS. Initially a simplifying game theoretical model has been shown to produce the predictions that a violated country's incentive to file a complaint is increasing in its own economic size, the value of the commodities at stake and its retaliatory capacity. The level of litigation costs as well as the economic size of the offender have been found to be detrimental to a violated country's incentive to file a complaint. From a theoretical perspective, these results may not be too surprising since they mirror the findings of Kennan and Riezman (1988)[14] who showed that a country can benefit from a tariff war as compared to free trade if it is only large enough. In the DSS game, it is basically up to the offender to decide between free trade and a (regulated) tariff war. If the offender is large enough compared to the victim, he will prefer the tariff war, choose not to comply and take the potential retaliation into account.

Controlling for the value of the disputable commodities and adding a crude proxy for the retaliatory capacity of the victim, the theoretical predictions are generally confirmed by the results of a binary regression model, using data on 195 complaints from 1995 through 2005. One major issue in the course of the preparation of this paper's data set has been to set up a statistical criterion to decide which trading partners have been injured. The criterion used here, concentrates on detecting a drop in the relative bilateral trade value of the disputable commodity. Modifications of this selection criterion leave the estimated coefficients' signs and significance levels unaffected. Moreover, the empirical results reproduce the findings of a similar approach by Bown (2005)[2], who focusses on 54 disputes from 1995 through 2000 for which there is certain information on the affectedness of victims available.

An additional empirical finding of this paper is that one should not expect to observe poor countries filing complaints just because they are heavily dependent on their (disputable) exports, even if these exports are very large in terms of their own GDP. In line with theoretical arguments, the relative value of disputable exports (i.e.  $\frac{DTV}{GDP_V}$ ) does not serve to explain the observed behavior in the sample.

At first sight, the results of this paper seem to be contrasting Guzman & Simmons (2005)[8] who find that a small victim is more likely to file a complaint against a bigger

offender than against an offender of about the same size. However, when controlling for the value of the disputable commodity at stake, it seems to be the case that Guzman & Simmons' "David-against-Goliath-effect" is not driven by country sizes but rather by the disputable trade value at stake.

Furthermore, the empirical findings of this paper raise implications for a potential bias of the DSS' usage. The estimated coefficients of the model predict that the observed set of complainants is biased towards those cases where the victim is large, the offender is small, the disputable trade value is high and the victim's retaliatory capacity is large. Moreover, the disentanglement of the separate effects of these variables unambiguously suggests that, all else equal, bigger countries do have a greater incentive than smaller countries for using the DSS.

While this paper answers the question whether the use of the system is biased towards large countries in the affirmative, it may be complementary to the results of Horn et. al. (1999)[11], who find that the number of product market pairings serves to explain how often a country has been involved into a dispute. However, their analysis is based on the set of those disputes that have been notified to the WTO, and from what has been argued in this paper, this observable subset should not be representative but rather biased. Merging these two results suggests that while the binary decision of whether or not to complain depends upon the identified variables that are specific to countries and commodities, a country's frequency with which it faces an infringement may very well be proportional to the number of bilateral product market pairings.<sup>53</sup>

---

<sup>53</sup>The author cannot imagine a reason for why the number of a country's product market pairings should affect the binary decision of whether or not to complain, given a particular offense. However, the number of infringements a country commits or suffers from may very well be proportional to its product market pairings if one assumes that offenses occur randomly and separately in each product market pairing. Consequently, a sequential two step model would be needed to predict the number of a country's observed participation as a complainant. In the first step, countries would be offended randomly and proportional to their number of product market pairings in the spirit of the Horn et. al. (1999)[11] approach. In the second step, the binary decision whether to complain against each of these infringements would be made according to the binary decision model presented in this paper.

## 8 Appendix

### 8.1 Uniqueness of the Pooling Equilibrium of Lemma 1

Lemma 1 states that  $\gamma \geq \frac{\Pi}{R_O}$  renders the following system of strategies and beliefs a unique perfect Bayesian pooling equilibrium.

#### Pooling Equilibrium 1 (PE1)

Victim's strategy:  $(complain|STRONG), (complain|WEAK)$

Offender's strategy:  $(comply|IS_c)$

Offender's beliefs:

$$Prob(a|IS_c) = Prob(c|IS_{dc}) = \frac{\gamma}{\gamma+(1-\gamma)} = \gamma$$

$$Prob(b|IS_c) = Prob(d|IS_{dc}) = \frac{1-\gamma}{\gamma+(1-\gamma)} = 1 - \gamma$$

PE1 has already been shown to constitute a perfect Bayesian pooling equilibrium. To show it is the only equilibrium existing for  $\gamma \geq \frac{\Pi}{R_O}$ , one has to check the remaining combinations of strategies and beliefs that could constitute an equilibrium. In order to rule out that a combination of strategies and beliefs does not constitute an equilibrium, it is sufficient to show that at least one of the strategies is not a best response.<sup>54</sup>

#### Potential Pooling Equilibrium 2 (PPE2)

Victim's strategy:  $(complain|STRONG), (complain|WEAK)$

Offender's strategy:  $(don'tcomply|IS_c)$

Offender's beliefs: The same as in PE1.

This system of strategies and beliefs does not constitute an equilibrium since the offender has an incentive to deviate to "comply". The reason being that the offender's expected payoff from complying (which is always zero) exceeds the expected payoff from not complying iff  $\gamma \geq \frac{\Pi}{R_O}$ .

#### Potential Pooling Equilibrium 3 (PPE3)

Victim's strategy:  $(don'tcomplain|STRONG), (don'tcomplain|WEAK)$

Offender's strategy:  $(comply|IS_c)$

---

<sup>54</sup>Some of the following proposed equilibria do not constitute an equilibrium since several strategies are not a best response. However, for simplicity only one strategy which is not a best response will be shown for each case.

Offender's beliefs: The same as in PE1.

This system of strategies and beliefs does not constitute an equilibrium since victims would deviate to "complain", anticipating the offender's compliance.

#### **Potential Pooling Equilibrium 4 (PPE4)**

Victim's strategy: (*don'tcomplain*|*STRONG*), (*don'tcomplain*|*WEAK*)

Offender's strategy: (*don'tcomply*| $IS_c$ )

Offender's beliefs: The same as in PE1.

This system of strategies and beliefs does not constitute an equilibrium since a strong victim would deviate to "complain" if  $R_V > C$ , which has not been ruled out. Moreover, it has been shown that (*don'tcomply*| $IS_c$ ) is not a best response for the offender, given his beliefs.

#### **Potential Separating Equilibrium 1 (PSE1)**

Victim's strategy: (*complain*|*STRONG*), (*don'tcomplain*|*WEAK*)

Offender's strategy: (*comply*| $IS_c$ )

Offender's beliefs:

$$Prob(a|IS_c) = Prob(d|IS_{dc}) = 1$$

$$Prob(b|IS_c) = Prob(c|IS_{dc}) = 0$$

This system of strategies and beliefs does not constitute an equilibrium since weak victims would want to disguise themselves as strong types and deviate to "complain".

#### **Potential Separating Equilibrium 2 (PSE2)**

Victim's strategy: (*complain*|*STRONG*), (*don'tcomplain*|*WEAK*)

Offender's strategy: (*don'tcomply*| $IS_c$ )

Offender's beliefs: The same as in PSE1.

This system of strategies and beliefs does not constitute an equilibrium since the offender would deviate to "comply", believing that any complaint is filed by a strong victim.

#### **Potential Separating Equilibrium 3 (PSE3)**

Victim's strategy: (*don'tcomplain*|*STRONG*), (*complain*|*WEAK*)

Offender's strategy: (*comply*| $IS_c$ )

Offender's beliefs:

$$Prob(a|IS_c) = Prob(d|IS_{dc}) = 0$$

$$Prob(b|IS_c) = Prob(c|IS_{dc}) = 1$$

This system of strategies and beliefs does not constitute an equilibrium since the offender would deviate to “don't comply”, believing that any complaint is filed by a weak victim.

#### **Potential Separating Equilibrium 4 (PSE4)**

Victim's strategy: (*don't complain*|*STRONG*), (*complain*|*WEAK*)

Offender's strategy: (*don't comply*| $IS_c$ )

Offender's beliefs: he same as in PSE3.

This system of strategies and beliefs does not constitute an equilibrium since weak victims would deviate to “don't complain”, anticipating that the offender will not comply.

## **8.2 Uniqueness of the Pooling Equilibrium of Lemma 2**

Lemma 2 states that  $\gamma < \frac{\Pi}{R_O}$  and  $R_V \leq C$  renders the following system of strategies and beliefs a unique perfect Bayesian pooling equilibrium. The former subsection's PPE4 has now turned into a pooling equilibrium.

#### **Pooling Equilibrium 4 (PE4)**

Victim's strategy: (*don't complain*|*STRONG*), (*don't complain*|*WEAK*)

Offender's strategy: (*don't comply*| $IS_c$ )

Offender's beliefs:

$$Prob(a|IS_c) = Prob(c|IS_{dc}) = \frac{\gamma}{\gamma+(1-\gamma)} = \gamma$$

$$Prob(b|IS_c) = Prob(d|IS_{dc}) = \frac{1-\gamma}{\gamma+(1-\gamma)} = 1 - \gamma$$

PE4 has already been shown to constitute a perfect Bayesian pooling equilibrium. To show it is the only equilibrium existing for  $\gamma < \frac{\Pi}{R_O}$  and  $R_V \leq C$ , one has to check the remaining combinations of strategies and beliefs that could constitute an equilibrium. Since the set of potential equilibria has already been introduced in the previous subsection of this Appendix, the proof will continue by checking whether each of these combinations is an equilibrium or not.

Under  $\gamma < \frac{\Pi}{Ro}$  the former subsection's PE1 is now no longer an equilibrium since (*comply*| $IS_c$ ) is not a best response for the offender.

PPE2 is no equilibrium since a weak victim would deviate to "don't complain".

PPE3 is no equilibrium since victims would deviate to "complain".

All potential separating equilibria do not constitute an equilibrium for exactly the same reasons as under the assumptions of the the previous subsection.

### 8.3 Included Disputes

The following list of numbers refers to the numbers of the disputes as filed in the records of the WTO.

#### Numbers of Disputes Included

1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19, 21, 23, 24, 25, 26, 27, 29, 31, 34, 41, 44, 48, 49, 52, 54, 55, 56, 58, 60, 62, 63, 64, 65, 66, 67, 68, 72, 74, 75, 76, 77, 78, 81, 84, 85, 87, 89, 97, 98, 99, 101, 102, 105, 109, 110, 112, 119, 121, 122, 123, 132, 134, 137, 138, 140, 141, 142, 143, 144, 145, 146, 147, 148, 151, 154, 155, 156, 157, 158, 159, 161, 164, 165, 166, 167, 169, 175, 177, 178, 179, 180, 181, 182, 184, 185, 187, 189, 191, 195, 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 218, 219, 223, 225, 226, 227, 229, 230, 231, 233, 235, 236, 238, 240, 241, 243, 244, 245, 247, 250, 255, 256, 257, 260, 262, 263, 264, 269, 270, 271, 272, 276, 277, 278, 280, 281, 286, 287, 288, 295, 296, 297, 299, 300, 302, 303, 305, 306, 308, 309, 310, 311, 312, 313, 314, 319, 323, 326, 327, 328, 329, 330, 332, 333, 334, 335

### 8.4 Consequences of Erroneous Selection of Victims

The decision rule on the selection of injured countries, which is stated in Assumption 2 focusses on maintaining a low alpha error, i.e. on maintaining a low probability for the erroneous judgement of an injured country as being a non-injured country. Clearly this is done at the cost of a high beta error, which is the probability of erroneously judging a non-injured country as being injured. Hence, the population of victims used for the regression is likely to contain a significant share of countries that did not suffer from the disputable trade measure although these WTO members shipped the particular commodity to the offender.

In order to get an idea about the consequences for the regression, it is useful to consider the distributional properties of the regressors that are used in the probit model (i.e.  $DTV$ ,  $GDP_O$ ,  $GDP_V$ ,  $GDPPC_V$ ,  $X_{OV}$ ). The following Table 10 shows that these variables do not differ much between the subsample of injured non-complaining countries on the one hand and the subsample of non-injured non-complaining countries on the other hand. Tests for

Subsample Variable \ Variate	injured countries		non-injured countries	
	mean	std. dev.	mean	std. dev.
$DTV$	726,412,476	2,435,306,156	281,106,763	1,307,548,531
$GDP_O$	6.61624E+12	3.49599E+12	6.36563E+12	3.89354E+12
$GDP_V$	1.78587E+12	3.05519E+12	6.08896E+11	1.74028E+12
$GDPPC_V$	11,600	11,922	11,782	11,505
$X_{OV}$	26,907,460,940	46,921,528,954	11,811,431,088	28,543,606,898

Table 10: Consequences of Erroneous Selection of Victims

common means of these variables accept the null hypothesis of a common mean on a 1% level. So it may be conjectured that there is no systematic difference between injured and non-injured countries in the regressors, given a country does not not complain. Consequently, favoring a low alpha error while taking into account a higher beta error, does not provoke a significant selection bias.

## 8.5 Robustness to Specification in Logarithms

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
$C$	-3.159760***	-2.0897*	1.1998	-3-3650	-3.3622
$\log(GDP_O)$	-0.1590***	-0.2005***	-0.2220***	-0.2188***	-0.2193***
$\log(GDP_V)$	0.1687***	0.1302***	0.1296***	0.1841***	0.1841***
$\log(DTV)$	0.1127***	0.1056***	0.1063***	0.1053***	0.1053***
$\log(X_{OV})$		0.0568*	0.0792**	0.0840***	0.0839***
$\log(EF_V)$			-0.7554***	0.3798	0.3798
$\log(GDPPC_V)$				-0.2054***	-0.2054***
$\log(GDPPC_O)$					0.0010
McFadden $R^2$	0.1813	0.1836	0.1887	0.1965	0.1965
Akaike	0.4635	0.4631	0.4610	0.4575	0.4583
Schwarz	0.4731	0.4751	0.4755	0.4743	0.4775
Hannan-Quinn	0.4670	0.4675	0.4663	0.4636	0.4653

Table 11: Probit Results for the Augmented Model in Logs with Constant under  $\Phi_4^{cut}(0.05)$

## 8.6 Robustness to Sample Selection Criteria

Variable\Criterion	$\Phi_4^{cut}(0.05)$	$\Phi_4^{cut}(0.1)$	$\Phi_3^{cut}(0.05)$	$\Phi_3^{cut}(0.1)$
$\log(GDP_O)$	-0.2553***	-0.2545***	-0.2596***	-0.2587***
$\log(GDP_V)$	0.0804***	0.0802***	0.0790***	0.0803***
$\log(DTV)$	0.1078***	0.1071***	0.1090***	0.1087***
$\log(X_{OV})$	0.0910***	0.0913***	0.0962***	0.0945***
Akaike	0.4638	0.4743	0.4353	0.4465
Schwarz	0.4734	0.4841	0.4443	0.4558
Hannan-Quinn	0.4673	0.4779	0.4386	0.4499
Observations	2,409	2,338	2,599	2,506

Table 12: Probit Results for Logarithmic Data under Various Sample Selection Criteria

## References

- [1] ANDERSON, K. Peculiarities of Retaliation in WTO Dispute Settlement. *Centre for Economic Policy Research Discussion Paper Series*, 3578 (2002).
- [2] BOWN, C. P. Participation in WTO Dispute Settlement: Complaints, Interested Parties and Free Riders. *World Bank Economic Review* 19, 2 (2005), 287–310.
- [3] BOWN, C. P., AND HOEKMAN, B. M. WTO Dispute Settlement and the Missing Developing Country Cases: Engaging the Private Sector. *Journal of International Economic Law* 8, 4 (2005), 861–890.
- [4] BRODA, C., LIMA, N., AND WEINSTEIN, D. E. Optimal Tariffs: The Evidence. *National Bureau of Economic Research Working Paper Series 12033* (2006).
- [5] BRONCKERS, M., AND VAN DEN BROEK, N. Financial Compensation in the WTO. *Journal of International Economic Law* 8, 1 (2005), 101–126.
- [6] GREENE, W. H. *Econometric Analysis*, 5. ed. Prentice Hall, Upper Saddle River, NJ, 2003.
- [7] GREGORY SHAFFER, V. M., AND QURESHI, A. Towards A Development-Supportive Dispute Settlement System in the WTO. *International Center for Trade and Sustainable Development Resource Paper* 5 (2003).
- [8] GUZMAN, A. T., AND SIMMONS, B. Power Plays & Capacity Constraints: The Selection of Defendants in WTO Disputes. *Journal of Legal Studies* 34 (2005), 557–598.
- [9] GWARTNEY, J., AND LAWSON, R. *Economic Freedom of the World, 2006 Annual Report*. The Fraser Institute, 2006.
- [10] HORN, H., AND MAVROIDIS, P. C. The WTO Dispute Settlement Data Set. *The World Bank* (2006).
- [11] HORN, H., MAVROIDIS, P. C., AND NORDSTRÖM, H. Is the Use of the WTO Dispute Settlement System biased? *Centre for Economic Policy Research Discussion Paper Series* 2340 (1999).
- [12] JORDAN, M. Sanktionsmöglichkeiten im WTO-Streitbelegungsverfahren. *Hamburger Studien zum Europäischen und Internationalen Recht* 41 (2005).

- [13] JUDGE, G. G., HILL, R. C., GRIFFITHS, W. E., LÜTKEPOHL, H., AND LEE, T.-C. *Introduction to the Theory and Practice of Econometrics*, 2. ed. Wiley, 1988.
- [14] KENNAN, J., AND RIEZMAN, R. Do Big Countries Win Tariff Wars? *International Economic Review* 29, 1 (1988), 81–85.
- [15] KOVENOCK, D., AND THURSBY, M. GATT, Dispute Settlement and Cooperation. *National Bureau of Economic Research Working Paper Series 4071* (1992).
- [16] MILES, M. A., HOLMES, K. R., O’GRADY, M. A., EIRAS, A. I., SCHAEFER, B. D., AND KIM, A. B. *2006 Index of Economic Freedom*. Heritage Foundation, 2006.
- [17] NORDSTRÖM, H. The Cost of WTO Litigation, Legal Aid and Small Claim Procedures. *Discussion Paper at the 2005 Conference of the Center for World Affairs and the Global Economy (WAGE) at the University of Wisconsin, Madison* (2005).
- [18] RASMUSEN, E. *Games & Information*, 3. ed. Blackwell, Malden, MA, 2001.
- [19] SUBRAMANIAN, A., AND WATAL, J. Can TRIPS Serve as an Enforcement Device for Developing Countries in the WTO. *Journal of International Economic Law* 3, 3 (2000), 403–416.