

The Economics of WTO Arbitrations

Chad P. Bown[†]
Brandeis University

Michele Ruta[‡]
WTO

This version: July 2008

Abstract

WTO arbitrators rely on economics to establish the permissible retaliation limits authorized by the Dispute Settlement Understanding (DSU) which arguably serves to enforce the overall agreement. We examine how theoretical and quantitative economic analysis has and can be used in this stage of the DSU process. First, we identify, characterize, and categorize the major classes of disputes – e.g., those affecting import protection versus export promotion – and use the Bagwell and Staiger interpretation of the WTO principle of reciprocity to provide a theoretical framework that arbitrators can use to identify the maximum level of retaliatory countermeasures. Second, we allocate each of the ten DSU arbitrations that have taken place thus far into one of these categories and compare the arbitrators' actual approach with the theory. Third, we use this framework to identify three crucial elements to the arbitrators' decision-making process for each case: i) the *formula* that they decide to adopt for identifying appropriate countermeasures, ii) their political-legal-economic decision on a WTO-consistent *counterfactual* to use to implement the formula, and iii) the *quantitative methods* they use to necessarily construct the (unobserved) WTO-consistent counterfactual. Finally, in the disputes in which this reciprocity approach has not been used, we identify procedural difficulties that arbitrators confront thus highlighting the constraints that hinder their use of economic analysis in practice.

Keywords: WTO, DSU, arbitrations, reciprocity, retaliation, market access, terms-of-trade externality

[†] Bown: Department of Economics and International Business School, MS021, Brandeis University, Waltham, MA 02454-9110, USA tel: +1.781.736.4823, fax: +1.781.736.2269, web: <http://www.brandeis.edu/~cbown/>, email: cbown@brandeis.edu.

[‡] Ruta: Economic Research & Statistics Division, World Trade Organization, Centre William Rappard, Rue de Lausanne 154, CH-1211 Geneva 21, Switzerland, tel: +41.22.739.6354, fax: +41.22.739.5762, email: michele.ruta@wto.org.

Bown was the visiting scholar in the Economic Research and Statistics Division at the WTO Secretariat while this paper was being written. Nevertheless, neither author was formally involved in any of the WTO dispute settlement activity described in this paper, and thus any views expressed are based on research alone and should not be attributed to the WTO, its Members, or any of its legal or economic staff. For helpful discussions and comments, the authors thank Robert Teh, Alex Keck, Marion Jansen, Marc Bacchetta, Patrick Low, and our discussant Alan Winters as well as participants at the Graduate Institute workshop on the Calculation and Design of Trade Sanctions in WTO Dispute Settlement in Geneva. Bown also thanks the German Marshall Fund of the United States for financial support of this project.

1 Introduction

Since the WTO's 1995 inception, ten formal Dispute Settlement Understanding (DSU) cases have reached the stage in which the respondent Member's failure to comply with WTO obligations compels DSU arbitrators to *authorize* the complaining Member to retaliate and apply countermeasures. This paper uses the lens provided by these ten cases to examine how arbitrators employ economic analysis at this critical stage of the DSU process. In order to lend an intellectual coherence to the arbitrators' approach, we first motivate the basis for DSU arbitrations in the WTO trade agreement via use of economic theory, as theory supplies a framework that complements the legal approach and allows arbitrators to put disputes into perspective.¹

We begin by developing a theoretical approach that facilitates examination of the countermeasure construction for each of the two major categories of prevalent cases in WTO dispute settlement – e.g., disputes over WTO-inconsistent import-restricting and export-promoting policies. This is an important initial categorization given that DSU arbitrations have been conducted under two different mandates – those that involve WTO-inconsistent trade restrictive measures and those that involve WTO-inconsistent government subsidies (WTO, 2005). In the first, pursuant to DSU Article 22.7, the duty of the arbitrators is to determine whether the level of suspensions sought by a complaining Member is "equivalent to the level of nullification and impairment" that resulted from the breach of WTO obligations. The second mandate, pursuant to Articles 4.10 and 4.11 of the Subsidies and Countervailing Measures (SCM) Agreement, requires arbitrators to evaluate whether proposed countermeasures by a complaining Member are "appropriate" in response to a prohibited export subsidy implemented by another Member.²

We adopt a theoretical approach for determining the limits to permissible DSU countermeasures that derives simply from the Bagwell and Staiger (2002) interpretation of the WTO principle of

¹ Sebastian (2008), also in this volume, describes the legal framework controlling the calculation and design of trade sanctions in the WTO dispute settlement process.

² Note that we do not use our framework to examine the *U.S. – Section 110(5) of U.S. Copyright Act (EC)* case, which fell under the DSU Article 25 arbitration that is an "alternative means of dispute settlement" (DSU Article 25.1).

reciprocity. A particular benefit of this approach is that it fits within one fundamental political-economic understanding of the purpose of the WTO as a trade agreement more broadly. We first adapt their interpretation of reciprocity in order to analyze separately the economic theory behind permissible retaliation for WTO-inconsistent import-restricting versus export promoting measures. Within these two broad categories, we focus on subsets of WTO-inconsistent measures disputed in practice. For import restrictions, we examine theoretical differences in the determination of countermeasures when the violation and/or WTO-consistent measure is a tariff, quota, other non-tariff measure on foreign exporters, or a domestic subsidy to import-competing firms. For export-promoting policies, we examine theoretical differences in the determination of retaliation limits when the WTO-inconsistent policies involve export subsidies in two-country and three-country models. Table 1 documents the ten DSU arbitrations that have taken place to date and allocates each one to the appropriate theoretical subsection of our analysis below.

Starting from the lens that the Bagwell and Staiger reciprocity formulation for countermeasure retaliation provides, we then turn to the actual arbitration cases. We first examine evidence from actual DSU reports to assess the extent to which the arbitrators' methods conform to the Bagwell and Staiger reciprocity formula. In some of the DSU cases that we examine, such as the arbitrations over WTO-inconsistent quantitative restrictions, the arbitrators' actual approach appears quite consistent with this theory. In other cases, the arbitrators explicitly signal in their report their preference to use such an approach despite the practical inability to do so for procedural, computational, or data limitation reasons. Furthermore, in other types of disputes involving export subsidies, arbitrators clearly deviate from this reciprocity approach in favor of alternatives. Nevertheless, even in such instances, analyzing the retaliation determination question from a theoretically-motivated perspective allows us to compare the arbitrators actual approach to one that might occur under this particular formulation of reciprocity.

Thus the basic theoretical framework to examining such DSU arbitrations allows us to identify the three crucial elements to the arbitrators' decision-making process: i) the *formula* that they decide to adopt for evaluating appropriate countermeasures, as well as its potential relationship to the theoretically-motivated Bagwell and Staiger reciprocity approach that is our benchmark; ii) their political-legal-

economic decision on a WTO-consistent *counterfactual* policy necessary to use the formula that they provide; and iii) the *quantitative methods* they choose to use to necessarily construct the (unobserved) WTO-consistent counterfactual in reality.³ Thus, after introducing our basic theoretical approach via use of a simple graphical analysis to exemplify the underlying theoretical issues in arbitrations, we then describe elements of the quantitative methodologies used by arbitrators to evaluate the maximum allowable level of suspension of concessions. Nevertheless, this particular element of the dispute process has received substantial discussion elsewhere, so we do not focus on it here.

Note finally that we restrict attention to the economics that arbitrators use to determine the maximum limits to retaliation.⁴ We do not examine other retaliation-related issues in which the arbitrators play a lesser role, especially questions such as – given the level of permissible retaliation set by the arbitrators, what are the political-economic determinants of the target lists that complainants draw up? In which sectors do complainants choose to implement retaliation? When does it make sense for a complainant to choose GATT, GATS, or TRIPs retaliation? While all extremely interesting questions, since they are touched on elsewhere in this volume and they are less relevant to the decisions made by the arbitrators, we focus here solely on the core questions surrounding determination of the *limits* to arbitrator-permitted retaliation.

The rest of this paper proceeds as follows. In section 2, we present the basic underlying model, the motivating underlying Bagwell and Staiger political-economic theory behind the WTO, as well the role and interpretation of the reciprocity principle that is so crucial to identifying a theoretical formula for the arbitrators' allowances for countermeasures. In section 3, we then apply the theory to cases in which WTO-inconsistent policies involved import-restricting measures, and we examine the relationship between actual DSU arbitrations over import-restricting measures and this theory. In section 4, we apply

³ We also choose not to pursue more normative questions such as whether particular arbitration decisions "make sense" from the perspective of economic theory or techniques. Furthermore, we leave untouched the question of the economic rational behind and the proper design of WTO rules governing arbitrations and hence the issue of whether decisions made by arbitrations has served to enhance the performance of the WTO's dispute settlement process more generally.

the theory to cases in which WTO-inconsistent policies involved export-promoting measures, and we examine the relationship between actual DSU arbitrations over these measures and this theory. Section 5 identifies other potential areas of theoretical interest given the DSU arbitrations that have occurred thus far, and section 6 concludes.

2 The Bagwell-Staiger Theory of Trade Agreements and the "Reciprocity Approach"

We start by providing an economic model to organize thoughts on the actual arbitration cases. The basic political-economic model that we introduce is in the spirit of Bagwell and Staiger (2001a), who show that the major principles of reciprocity and non-discrimination of the WTO system allow countries to escape a terms-of-trade driven prisoners' dilemma.⁵

To begin, we assume that there are two large countries – the respondent (R) and the complainant (C) – and we note that the complainant's variables will be denoted by *. Let good x be the natural import (export) good of the respondent (complainant) country and let y be the natural import (export) good of the complainant (respondent) country, and we assume that these goods are traded in perfectly competitive markets. For example, the markets for good x are illustrated in figure 1. The model is thus a two country, two good, partial equilibrium model, and one in which we assume governments use the policy tools at their disposal to maximize an objective function consisting of a "politically" weighted sum of consumer surplus, producer surplus, and tariff revenue across their two sectors.⁶

⁴ See, in particular, WTO (2005), Keck (2004), Bernstein and Skully (2003), and Breuss (2004).

⁵ Bagwell and Staiger (2001a) is the partial equilibrium version of the model they originally introduced in a general equilibrium framework in Bagwell and Staiger (1999). The Bagwell and Staiger (2001a) model can be interpreted as a general equilibrium model by introduction of a numeraire good whose trade is determined by a requirement of overall trade balance. For a book-level synthesis of these theories, see Bagwell and Staiger (2002).

⁶ If "political" weight were all equal to unity, the objective function of governments would correspond to social welfare. As it is well understood from the theory of collective action (Olson, 1965) and confirmed by a large body of empirical evidence (Gawande and Krishna, 2003, present a survey), governments tend to favor (i.e., give a higher weight in their objective function) organized special interests, such as import-competing industries, relative to diffuse interests as consumers'. Grossman and Helpman (1994) lobbying model provides a micro-analytic foundation to this political economy representation.

In such an environment, the WTO principle of reciprocity serves to neutralize an important externality: the world-price (or the terms-of-trade) effects of a country's trade policy decisions, whereas a country can use unilateral trade measures (and their effects on world prices) to redistribute surplus from its trading partner to itself. The WTO principle of non-discrimination through most-favored-nation (MFN) treatment ensures that externalities associated to trade intervention travel through world prices only. In this way, these principles work in concert to deliver *efficient* trade policy outcomes from the multilateral trading system (i.e., outcomes that do not distort trade more than if each government were motivated by domestic political-economy considerations only).⁷

We therefore begin our theoretical analysis from such an efficient trade agreement between symmetric countries, that is an agreement that eliminates the trade restrictions associated to the terms-of-trade externality. The trade agreement is efficient in light of each government's potential political preferences, and therefore does not necessarily result in free trade – i.e. government preferences might be such that their “politically optimal” (efficient) trade policies in this Bagwell and Staiger framework are not zero.

Following the approach adopted in Bown (2002, 2004), we then introduce an unanticipated “political” shock that stimulates a desire by one of the governments – the respondent - to *change* the terms of the existing agreement. The intuition is simply that the political shock creates new preferences by changing the relative weights the government in the respondent faces vis-à-vis its various sectors, thus its existing policies are no longer efficient from its new perspective. While the nature of the shock is “political,” it leaves unaltered domestic demand and supply.⁸ A concrete example of this type of shock would be the election of a new government that weights more heavily the interests of the import-

⁷ As discussed in Bagwell, Mavroidis and Staiger (2002), the terms-of-trade rationale for trade agreements corresponds to the market access emphasis found in the WTO articles. An increased (reduced) export price, that is an improved (diminished) terms of trade, is just the price effect induced by the corresponding increase (reduction) in export volumes that augmented (restricted) market access implies.

⁸ This is certainly not the only type of shock that might trigger such a policy change, though it is perhaps most simple to use in the model to examine the questions of interest here. Nevertheless, we identify and discuss other types of shocks in section 5.

competing sector (i.e., producers' surplus), which creates an incentive for the government to move away from the trade policy commitments previously negotiated with its trading partner in an earlier round.

In the simplest case we explore first, the government in the respondent reacts to this preference shock by imposing more import *restrictions* either directly via trade policy (e.g., tariffs, quotas or other non-tariff barriers) or by providing its domestic producers with a WTO-inconsistent subsidy that leads to a similar effect of limiting trade. The key from the WTO's perspective is that these policies all limit market access and change the conditions of competition between domestic and foreign producers away from those that could have reasonably been expected based on earlier negotiated commitments. In the second set of cases, we examine respondent policymakers who react to preference shocks that cause them to seek to expand export *promotion* activity – e.g., export subsidies – above WTO commitments.

Given the respondent country's change in policies, we then use the basic rules of the WTO's Dispute Settlement Understanding to examine how the setting plays out. I.e., after the respondent reacts to this "shock" by changing some policy that affects its WTO commitments, we assume that the adversely affected complainant country files a formal trade dispute. The parties then go through the DSU judicial process of legal argumentation, the respondent's policy is found by the panel and Appellate Body to be WTO-inconsistent, and we finally reach the stage of DSU arbitration. Assuming that the respondent has thus far refused to bring its measure into conformity with DSU rulings, it is the task of the arbitrators to define the limits of the complainant country's permissible retaliation as a response to the respondent country's initial WTO-inconsistent measure.

The DSU states that "the level of the suspension of concessions or other obligations authorized by the DSB shall be equivalent to the level of *nullification or impairment*" (GATT, 1994, Article 22:4, emphasis added). In each subsection below corresponding to a different WTO-inconsistent policy, our approach is to provide a simple graphical model to evaluate the level of nullification or impairment that arises. While (as discussed in Pauwelyn, 2008, in this volume) there is not a single interpretation on the "proper" level of nullification or impairment, in this paper we adopt the Bagwell and Staiger (2002) view that this level corresponds to the *suspension of trade that is designed to stabilize the value of export and*

imports trade volumes between countries. For instance, in the case of a trade restrictive measure, the complainant's permissible retaliation is to reduce the volume of the exports by an amount equal to the respondent's reduction of imports, both measured at original export prices (i.e. before the breach in WTO commitments). We will refer to this approach to evaluate the appropriate level of nullification or impairment as the "reciprocity approach." Howse and Staiger (2005) argue that this approach approximates a system of remedies that facilitates a form of "efficient breach" of the optimal trade treaty in presence of uncertainty.⁹ Furthermore, they show that allowing the complainant to retaliate at a level equal to trade effects calculated at original export prices preserves the terms-of-trade and is close to an efficient response for "small" shocks.¹⁰

In sections 3 and 4, we use this approach to evaluate the level of nullification or impairment in the case of import restrictive measures (e.g., tariff, quota, other NTMs) and then in the presence of export promoting policies (e.g., export subsidies).

3 WTO Disputes and Retaliation over Import-Restricting Measures

In this section we study the process of arbitrator determination of countermeasures when the WTO-inconsistent policies are those that excessively restrict imports. We first lay out the simple theoretical approach to this question and then examine how the arbitrators in the relevant DSU caseload have approached the question in practice. As described in the introduction, our methodology is to use the Bagwell and Staiger interpretation of the reciprocity approach to provide a theoretical framework to identifying the appropriate level of countermeasures. We then use this framework to identify three crucial elements to the arbitrators' decision-making process: i) the formula that they decide to adopt for evaluating appropriate countermeasures, ii) their political-legal-economic decision on a WTO-consistent

⁹ For a discussion of trade agreements as incomplete contracts and the analogy between the reciprocity approach to calculate appropriate trade sanctions and the concept of "expectation damages" in private contract law, see Sykes (2008) in this volume and the references therein.

¹⁰ Nevertheless, there are also some limitations to such an approach that we also identify and describe in substantial detail below, especially when it comes to the question of *implementation* of such an approach in practice.

counterfactual to use in the formula, and iii) the quantitative methods they choose to use to necessarily construct the (unobserved) WTO-consistent counterfactual.

For illustrative purposes, we start our discussion of import-restricting measures with the case of tariffs. While none of the actual arbitration cases deals exclusively with this most simple trade policy measure, tariff analysis constitutes a valuable benchmark. Once we have established how the approach works to understand the basic tariff case, we then modify it appropriately to examine WTO-inconsistent quotas, which is relevant for five DSU arbitrations: *EC – Banana Regime (U.S. and Ecuador)*, *EC – Beef Hormones (U.S. and Canada)*, and *U.S. – Internet Gambling*. We then also extend the approach to consider the case of WTO-inconsistent domestic subsidies and other non-tariff measures, which are relevant for the arbitrations in *U.S. – Continuing Dumping and Subsidy Offset Act (Byrd Amendment)* and *U.S.-Antidumping Act of 1916*.

3.1 Import tariffs

In our benchmark case, we assume that governments have a single policy tool – import tariffs - at their disposal. At the initial WTO-type agreement between the two countries and before introduction of any shocks, the efficient level of the policies embedded in the agreement are given by τ^E, τ^{*E} , i.e., the efficient tariffs on imports of x (y) imposed by the respondent (complainant) country.

Panels a. and c. of figure 1 illustrate the demand (D_x and D_x^*) and supply (S_x and S_x^*) schedules for good x in the responding country and the complaining country respectively, while panel 1b. shows the export supply (X_x^*) and import demand (M_x) schedules in international markets. As we are assuming that the world is only composed of these two countries, export supply and import demand are entirely determined by the domestic conditions in the respondent's and the complainant's market. In particular, notice that in the relevant price range, the complainant produces more of the goods than it demands (and exports the rest, so that $X_x^* = S_x^* - D_x^*$, which is strictly positive for any price level larger than the equilibrium price in the complainant's market), while the respondent demands more than it

produces (and imports the rest, so that $M_x = D_x - S_x$ which is strictly positive for any price lower than the respondent's equilibrium price under autarky). At the initial (efficient) tariff, the world price and the volume of trade are determined by the intersection of the export supply (X_x^*) and import demand (M_x^0) schedules at point E^0 in panel 1b. and are denoted with $P_x^0 \equiv P_x(\tau^E)$ and $Q_x^0 \equiv Q_x(\tau^E)$.

Now assume that the respondent (R) country experiences a shock and unilaterally alters its policy from this initial level to some (non-prohibitive) level τ^1 . The introduction of a higher non-prohibitive tariff ($\tau^1 > \tau^E$) in country R increases its domestic price and lowers the price in the international market, as the reaction of exporters to the increased cost creates an excess demand of the good in the respondent's market and an excess supply in the international market. Because of these price changes, producers in R supply more of the good and consumers demand less (see panel 1a.), while in country C producers supply less and consumers demand more (see panel 1c.). This implies a shift down in the import demand schedule in panel 1b. from its original position M_x^0 to the new level M_x^1 . In the new equilibrium (E^1), imports and exports are lower. The effect of the restrictive measure on the volume of trade corresponds to a fall from Q_x^0 to $Q_x^1 \equiv Q_x(\tau^1)$. The introduction of this new and more restrictive measure in country R will affect the price of good x which falls from its initial level $P_x^0(\tau^E)$ to the lower level $P_x^1(\tau^1)$.

The key question that we address is the one that the WTO-arbitrators face: what is the level of retaliation that the complainant should be entitled to? I.e., how should C be allowed to respond by changing its tariff policy τ^* on imports of y from the respondent?

As informally discussed in the previous section, we adopt an approach based on the principle of reciprocity to address this question. With the notation introduced here, we are now ready to formally restate the reciprocity condition as a mathematical equation: i.e., following Bagwell and Staiger (2001a), under the reciprocity approach, the complainant is allowed to introduce a retaliatory policy measure (call it τ^{*Ret}) – i.e. a trade restrictive measure on the imports of good y from country R - such that the value of export and import trade volumes between the two countries is stabilized, that is:

$$P_x^0(\tau^E)[Q_x^0(\tau^E) - Q_x^1(\tau^1)] = P_y^0(\tau^{*E})[Q_y^0(\tau^{*E}) - Q_y^{\text{Ret}}(\tau^{*\text{Ret}})], \quad (1)$$

where $P_y^0(\tau^{*E})$ is the initial export price of good y , $Q_y^0(\tau^{*E})$ are initial imports and $Q_y^{\text{Ret}}(\tau^{*\text{Ret}})$ is the volume of imports under the more restrictive measure.

At this point, we are ready to graphically evaluate the appropriate level of retaliation that the arbitrators should accord to the complainant under the reciprocity approach defined above. The reciprocal retaliatory response that would preserve the terms-of-trade between the respondent and the complainant corresponds to the volume of loss trade ($Q_x^0 - Q_x^1$) evaluated at the original export price (P_x^0) – i.e., which is the left-hand side of the reciprocity condition above. The value of the trade-effect corresponds to the shaded area in Figure 1b. Not surprisingly, this area is equal to the sum of the shaded areas in Figure 1a. (i.e., the value of loss imports at original export price) and the sum of shaded areas in Figure 1c. (i.e., the value of loss exports at the original export price).

3.1.1 Actual DSU arbitrations over import tariffs

While no arbitrations to date have involved purely a WTO-inconsistent tariff restrictions, insights from this section will be important to helping us understand some elements of the two *EC – Beef Hormones* arbitrations, that was largely a quota dispute, described in section 3.2.1 below.

3.2 Import quotas

While no arbitration dealt entirely with a breach of a tariff commitment, we can apply the logic just discussed to evaluate the level of nullification or impairment in the case of a WTO-inconsistent quota. Five out of ten arbitrations to date have dealt with this kind of trade restrictive measure.

With one exception we start with all of the same modeling assumptions in the previous subsection on import tariffs— assume that the respondent country only has access to an import quota policy on good x

instead of an import tariff. Again, we start from an efficient trade agreement (in light of the government's politically-weighted objective function) which implies a trade restrictive quota binding in country R.¹¹ This situation is depicted in figure 2a., which focuses only on the central panel of figure 1, illustrating the equilibrium in the international market. Differently from the tariff, the quota directly limits the amount of imports to the initial level Q_x^0 , which explains the kinked shape of the import demand function in figure 2a. I.e., for prices lower than P_x^0 , the initial export price, country R would be willing to import larger quantities of the good, as in the dotted line, but this is prevented by the existence of the quota limit.

Suppose now that the respondent experiences the same sort of political shock and it responds by changing its politically optimal quota from the legal volume Q_x^0 to the more restrictive, and WTO-inconsistent volume Q_x^1 . As a consequence of the imposition of this new measure, import demand from country R shifts in from M_x^0 to the new level M_x^1 . The effect of the lower quota will be to push up the consumer price for the respondent to P_x^1 (as the quantity demanded will exceed the quantity supplied by domestic and foreign producers) and push down the price received by the complainant's exporters to P_x^2 (as the more restrictive quota corresponds to a lower demand compared to the original situation).

Just as was the case for the import tariff, the next step of our analysis is to use the reciprocity principle to graphically evaluate the appropriate level of retaliation that the arbitrators should accord to the complainant. Before doing this, we note an additional complication. When a quota is used instead of a tariff, the secondary question arises as to how the import licences for use of the quota are allocated. I.e., because the quota limits competition in the respondent market, the price of good x in the respondent market is higher than the world price the exporters would receive for sales of the same good in other markets, and thus merely the right to export to this market (what we will refer to as the quota licence) is something of value that can be bought and sold. Thus in order for the arbitrator to know the complainant

¹¹ Let us stress again that the quota, as the tariff in the previous subsection, is "politically optimal". It is, therefore, efficient only in the sense that it does not imply the presence of a terms-of-trade prisoners' dilemma.

exporter's received price for its sales of x in the respondent market, the arbitrator must have knowledge over the form of the quota licence allocation regime as well as its WTO consistency. In figure 2a, the value of the quota licences – or what is frequently referred to as the ‘quota rent’ – is given by the cross-hatched rectangle.

Consider the range of extremes for potential WTO-consistent licencing schemes. First, if the particular case allows for a party in the complaining country (e.g., exporting firms directly, or perhaps their government) to receive the quota licenses directly without payment and therefore benefits from quota rents, then the relevant original exporter price is P_x^0 , and thus, modifying equation (1), the reciprocity defined level of retaliation permitted to the complainant country is given by:

$$P_x^0 [Q_x^0 - Q_x^1] = P_y^0 (\tau^{*E}) [Q_y^0 (\tau^{*E}) - Q_y^{\text{Ret}} (\tau^{*\text{Ret}})]. \quad (2)$$

Graphically in figure 2a, the permitted level of retaliation corresponds to the combined shaded and the cross-hatched areas.

At the other extreme, if the WTO-consistent licencing regime allows only for non-complaining country parties to be allocated the licences, then the effective foreign export price under the WTO-consistent quota is P_x^3 (and not P_x^0), since the foreign exporters would have to pay a price (equivalent to $P_x^0 - P_x^3$) simply to acquire a licence, therefore driving down the effective price they receive for their exports. In this event, the modification to equation (1) results in a reciprocity condition given by

$$P_x^3 [Q_x^0 - Q_x^1] = P_y^0 (\tau^{*E}) [Q_y^0 (\tau^{*E}) - Q_y^{\text{Ret}} (\tau^{*\text{Ret}})]. \quad (2')$$

In this case, the appropriate level of nullification or impairment in figure 2a corresponds to the fraction of the shaded area below the price P_x^3 only.

Of course these are the two extreme cases, as it is also possible to allocate some of the licences to foreign entities directly and some to non-foreign entities (which the foreign exporter would then have to acquire through payment to export) therefore allocating a portion of the quota rent rectangle in figure 2a to each group, and raising the effective price received by foreign exporters above P_x^3 but still below P_x^0 .

Note finally that if the only WTO-inconsistency associated with a quantitative restriction is the way in which import licences under the quota were distributed, the reciprocity approach indicates zero retaliation for the complainant country, since there was no volume effect ($Q_x^0 - Q_x^1 = 0$) of the respondent's WTO-inconsistent measure.

3.2.1 Actual DSU arbitrations over import quotas: *EC – Bananas (U.S. and Ecuador)* and *EC – Beef Hormones (U.S. and Canada)*

In this section we use the methodological framework of section 3.2 to help interpret what the Arbitrators did in practice. Five out of the ten arbitrations that have taken place thus far have been challenges to WTO-inconsistent quantitative restrictions: the two *EC – Banana* disputes (U.S., Ecuador), the two *EC – Beef Hormones* disputes (U.S., Canada) and the *U.S. – Internet Gambling* dispute. As the model presented in figure 2 suggests, if the arbitrators are going to follow the reciprocity approach to determining the level of countermeasures that the complainant parties can impose, they require three pieces of information to implement equation (2'): the actual level of exports under the WTO-inconsistent regime (Q_x^1), the counterfactual level of exports under a WTO-consistent regime (Q_x^0), and the counterfactual exporter price under a WTO-consistent regime (e.g., P_x^3).

EC – Bananas

Consider first the initial *EC – Bananas* arbitration, in which the complainant was the United States.¹² This is an interesting and precedential dispute in its own right as it was the first ever DSB case to proceed to the stage of arbitration.¹³ Since the arbitrators were the same in the *EC – Bananas* dispute involving Ecuador as a complainant and they followed a similar process for determining the appropriate level of countermeasures in that case, we focus primarily on discussing the U.S. arbitration here.¹⁴

Evidence from the *EC – Bananas* arbitrators' report is broadly consistent with the idea that they followed a "reciprocity approach" formula analogous to equation (2') to determine the U.S. level of countermeasures. First, the determination of the actual volume of U.S. banana exports under the WTO-inconsistent regime (Q_x^1) was taken from data on wholesale services trade for bananas sold in the EC market, and the U.S. share of this EC import market derived from the U.S. share of allocated import licences to the overall EC banana market. Then, the arbitrators sought information on the counterfactual level of exports (Q_x^0) and exporter price (P_x^3) that would occur under a WTO-consistent policy.

However, even if the arbitrators are following the reciprocity approach, the politically and economically challenging part of the arbitrators' exercise is, of course, to construct the appropriate counterfactual to deduce information on Q_x^0 and P_x^3 .¹⁵ While the arbitrators' exact methodology and

¹² *European Communities - Regime for the Importation, Sale and Distribution of Bananas - Recourse to Arbitration by the European Communities Under Article 22.6 of the DSU - Decision By the Arbitrators*, WT/DS27/ARB, 9 April 1999. For the Ecuador arbitration, see *European Communities - Regime for the Importation, Sale and Distribution of Bananas - Recourse to Arbitration by the European Communities Under Article 22.6 of the DSU - Decision By the Arbitrators*, WT/DS27/ARB/ECU, 24 March 2000.

¹³ Furthermore, this is seemingly the only dispute in which one of the arbitrators was an analytical research economist. See the discussion in Bown (this volume).

¹⁴ A separate and interesting issue for the Ecuador dispute was not on how the level of countermeasures was constructed, but the question of how Ecuador would have been authorized to implement them – i.e., via a potential withdrawal of TRIPs commitments, instead of via a withdrawal of tariff commitments under the GATT.

¹⁵ The process was politically challenging in this instance as the arbitrators first had to decide on what would have been a WTO-consistent *EC – Banana Regime* policy – i.e., a policy itself that had never been in place. The process was also economically challenging as the arbitrators had to then take the WTO-consistent policy as given and then potentially use quantitative economic tools to determine the U.S. export response under such a policy. We do not

data used is not publicly available from their report, their logic appears to have been the following. First, to determine the relevant exporter price, they essentially assumed that a WTO-consistent regime would leave the overall volume of imports (from all foreign sources) unchanged, and that EC production would also remain unchanged. Under this set of assumptions, the exporter price under the counterfactual that would need to be known is the same as the current exporter price, which is a statistic available in current year's data. In terms of figure 2a., this implies that in the relevant range the export supply schedule of the U.S. is flat (i.e., infinitely elastic) at the current export price (i.e., $P_x^3 = P_x^2$). Second, the arbitrators requested that the U.S. provide them with information on U.S. exports of bananas from four different counterfactual regimes that might be considered WTO-consistent. While knowledge of what led the arbitrators to be influenced from one of those scenarios more than the others is an unknown, the arbitrators used those submissions to construct their own measure for the counterfactual level of exports under a WTO-consistent regime, i.e., Q_x^0 .¹⁶

One finally interesting item to note from this dispute is the role of quota licences, again with reference to figure 2a. As we described in the theoretical section, whenever a trade restriction is imposed as a quota, an important secondary issue arises for arbitrators which require information on the WTO-consistent licence allocation scheme in order to determine the export price. For instance, if a WTO-consistent scheme is such that quota licenses are attributed to the U.S., then the relevant counterfactual exporter price would be P_x^0 rather than P_x^3 . As shown in figure 2a. (the cross-hatched area), the maximum admissible retaliation in the quota cases crucially hinges on the appropriate counterfactual export price which, in turn, depends on the decision on the WTO-consistent licensing scheme. From the information available in the report, however, it is difficult to assess the arbitrators' decision on this issue.

comment here on whether their political or economic approaches were appropriate in this case, as the information provided in the report was not sufficient to allow us to form such an assessment.

¹⁶ In order for the arbitrators to implement the reciprocity approach, they would require information on the volume of U.S. exports under the counterfactual and not the value. Nevertheless, given their assumptions discussed above which led them to separately determine exporter prices under a WTO-consistent counterfactual regime, they could easily use those prices and the proposed value of exports to back out a volume number.

EC – Beef Hormones

The next set of disputes involves the EC imposing WTO-inconsistent quantitative restrictions over hormone-treated beef imported from the United States and Canada.¹⁷ While the arbitrators' logic to determining the U.S. and Canadian level of countermeasures is related to the "reciprocity approach" that we describe, it does not follow exactly for a number of reasons. For space constraints, we focus here on the arbitrators' methodology in the U.S. case as the Canadian case was similar.

As relevant background information, the dispute involved two differentiated products. For the purpose of the arbitration, it is necessary to separate them, as the arbitrators' did, given the fact that the counterfactual WTO-consistent regimes were different for the two products – i.e., one was a quantitative restriction, and one was a tariff. The first product is high quality beef (HQB), a product that the EC banned because it had been treated with hormones, but a product for which the WTO-consistent policy was for the EC to have a defined quota programme of 11,500 tonne limit per year.¹⁸ The second product was edible beef offal (EBO) – a U.S. export product treated with hormones to which the EC also applied a ban, but in the absence of a ban would have faced an EC tariff and not a quota. The implication is that for the arbitrators, for one product (HQB) the approach would be based on the insights from this section and figure 2, and for the other product (EBO), the approach would be based on a combination of insights from this section and the last section on tariffs and thus figure 1. Thus we follow the arbitrators and analyze the

¹⁷ *European Communities – Measures Concerning Meat and Meat Products (Hormones) Original Complaint by the United States - Recourse to Arbitration by the European Communities Under Article 22.6 of the DSU - Decision By the Arbitrators*, WT/DS26/ARB, 12 July 1999; *European Communities – Measures Concerning Meat and Meat Products (Hormones) Original Complaint by Canada - Recourse to Arbitration by the European Communities Under Article 22.6 of the DSU - Decision By the Arbitrators*, WT/DS48/ARB, 12 July 1999.

¹⁸ First, there was a question about how much of the share of the EC's 11,500 tonne quota would be allocated to the U.S. versus Canada, and the arbitrators relied on the relative size of U.S. and Canadian HQB exports to common third markets to determine what their likely shares within the quota would have been had the ban not been in place and the U.S. and Canada allowed to export hormone-treated HQB to the EC – i.e., 92% for the U.S. and 8% for Canada. Second, the EC quota would have actually been implemented as a tariff rate quota and not pure quota – i.e., the in quota tariff rate was 20% ad valorem, and the out of quota tariff rate was reportedly prohibitive. Vis-à-vis figure 2, the implication is that the tariff rate quota grants the quota rents (cross-hatched rectangle) to the government via tariff revenue, and the price received by U.S. exporters would be p_x^3 .

two products separately. After calculating the separate amounts of retaliation related to the ban of each product, the arbitrators then summed their total.

First consider HQB, for which the WTO-consistent regime was a quota, and we begin with consideration of the determination of the counterfactual prices and quantities that would have occurred under the WTO-consistent regime – once again referring to figure 2a. and equation (2'). Here, the volume (Q_x^0) was relatively easy to calculate as it was the U.S. share of a previously determined EC quota of 11,500 tonnes per year. The counterfactual price that would have occurred under a WTO-consistent regime (P_x^3) is also relatively straightforward in this instance, and the arbitrators accepted a U.S. proposed price of \$5,342 per tonne. The logic behind this choice, however, is not articulated in the report.

Nevertheless, thus far, the arbitrators appear to follow this “reciprocity approach” of equation (2') as modified to fit the facts for HQB. The potential deviation from this approach occurs in the arbitrators' decision regarding what to use as the *actual* volume of U.S. and Canadian beef exports under the WTO-inconsistent regime – i.e., Q_x^1 in figure 2a. Calculation of this exercise was a controversial issue in *EC – Beef Hormones* between the parties for a number of interesting reasons, although for reasons separate to the central topic under consideration here.¹⁹ Unlike the *EC - Bananas* case discussed above, the arbitrators deviated from equation (2') by not looking for a current volume (Q_x^1) of EC imports of HQB from the U.S., but they relied on an estimate of the current *value*, i.e., $P_x^2 * Q_x^1$ from figure 2b.²⁰

¹⁹ The arguments between the EC and U.S. was the degree to which the EC ban on hormone-treated had reduced current exports of HQB. The U.S. argued that it was effectively a ban and thus the value of imports should be zero, while the EC disagreed and presented information on imports from the U.S. of HQB that had been allowed entry into the EC because, after testing, it was found not to have been treated with hormones. The arbitrators chose some middle ground and found that the value of U.S. current exports of non-hormone treated HQB to be \$23,853.584. The issue is one that arguably could have been resolved and addressed using quantitative economic techniques.

²⁰ See paragraphs 43 and 62 in the report. Interestingly, had the arbitrators adopted the approach taken in the U.S. submission, the value and volume of current would have been the same – i.e., zero – and thus the question of whether the arbitrators were using the appropriate price to precisely implement the reciprocity formula would not arise.

The methodological insight is that, instead of using the reciprocity formula of equation (2') and the area of $P_x^3 * (Q_x^0 - Q_x^1)$ (i.e., the shaded area below P_x^3 on figure 2a) to determine the appropriate level of countermeasures, the arbitrators decided to use a formula given by $P_x^3 * Q_x^0 - P_x^2 * Q_x^1$, which corresponds to the shaded area in figure 2b. Therefore, an implication of this formula change is that it allows for a *higher* level of countermeasures if $P_x^2 < P_x^3$, i.e., the current price received by U.S. exporters is *lower* than the counterfactual exporter price that would be received under a WTO-consistent regime.

Consider next the case of the second beef product (EBO), which is necessary to analyze separately both because it is a differentiated product and more importantly because EBO trade between the U.S. and EC under a “WTO-consistent regime” would have been a tariff and not a quantitative restriction. Thus the arbitrators were required to perform a similar exercise to that which they performed in the case of HQB, although in important ways the exercise is also distinct and more complex. First, note that when it came to EBO, the arbitrators followed their own formula and approach that they had developed for HQB and thus chose to base the overall retaliation calculation on a formula given by $P_x^3 * Q_x^0 - P_x^2 * Q_x^1$ instead of the reciprocity formula given by $P_x^3 * (Q_x^0 - Q_x^1)$.²¹

Nevertheless, the interesting *differential* element worth highlighting is the quantitative techniques the arbitrators used to construct the values for P_x^3 and Q_x^0 to implement their formula for the EBO product, i.e., the counterfactual exporter price and volume of exports under a WTO-consistent regime. The exercise for EBO was more difficult than was the case for HQB, given that the counterfactual WTO-consistent regime for EBO was a tariff and not a quantitative restriction. This implies that the arbitrators would have to take some methodological approach to constructing their own value for Q_x^0 , since it was not pre-determined by some negotiated quota limit as was the case for both HQB and the Banana dispute discussed above, but instead would be affected by market forces. In principle, even taking as given an

²¹ See paragraph 72 in the report.

acceptable value for P_x^3 - i.e., the counterfactual exporter-received price, perhaps under the assumption that the exporter is “small” and unable to affect world prices by changing their quantities supplied – an economist would typically rely on knowledge of EBO producers’ export supply response elasticities to construct the value for Q_x^0 that the arbitrators were forced to undertake in this exercise.²² While the arbitrators’ were aware of the market forces that would affect the level of imports under the WTO-consistent counterfactual (see paragraph 70), there is no mention of such elasticities in the report. Instead the description of their approach suggests that arbitrators made their determination for Q_x^0 by more simply relying on historical trends in the data and making adjustments for demand-side changes in the EC during this time period. Just as was the case for HQB, their choice of counterfactual price was to essentially go with what was suggested by the parties, raising the same economic questions as we identified above.

U.S. – Internet Gambling

The final DSU arbitration involving a WTO-inconsistent quota is the case brought by Antigua and Barbuda concerning the U.S. import ban on internet gambling services.²³ Compared to the arbitrations we have discussed thus far, at least two additional items worth highlighting arose in this dispute: the formula adopted by the arbitrators and the empirical difficulty confronting the arbitrators in implementing the formula. Note that we do not comment here on the question of the appropriateness of the arbitrator's choice of actual WTO-consistent counterfactual, but we simply focus on the formula for its determination and the quantitative techniques needed to employ it in practice.²⁴

²² See, for example, Francois and Reinert (1997). See also Armington (1969).

²³ *United States - Measures Affecting the Cross-Border Supply of Gambling and Betting Services Recourse to Arbitration by the United States under Article 22.6 of the DSU – Decision by the Arbitrators*, WT/DS285/ARB, 21 December 2007.

²⁴ As we describe elsewhere, economics could potentially play a role in the arbitrator's step 2 decision of the WTO-consistent policy – for example, if there are multiple such WTO-consistent counterfactuals, economic techniques

First, the arbitrators appear to have followed an approach that is quite close to the reciprocity formula presented in the theoretical section. If the U.S. measure in question essentially resulted in a ban on internet gambling services from Antigua, the current volume of exports (Q_x^1) needed to implement the formula is equal to zero.²⁵ Next, the arbitrators then attempted to calculate the counterfactual value of exports ($P_x^3 Q_x^0$) under a WTO-consistent U.S. policy toward imports of internet gambling services from Antigua. When $Q_x^1 = 0$, calculation of the reciprocity formula in equation (2') simply reduces to calculation of $P_x^3 Q_x^0$.

While information transparently provided in the arbitrators' report in this dispute makes clear what formula they were attempting to follow, it is also apparent from their report that actual computation of $P_x^3 Q_x^0$ was an extremely challenging exercise – both for reasons of data availability as well as the requirement of relatively sophisticated quantitative economic techniques. First, it is a well known general problem that trade flow data on the provision of services are typically very poor and difficult to obtain – data collection agencies have not simply not devoted sufficient resources to track services flows at the same level of detail as is the case for goods trade. Thus, the arbitrators were constrained by the relatively poor data with which they were given to work. Second, even after the arbitrators made their decision of WTO-consistent counterfactual outcome to use in the formula, establishing $P_x^3 Q_x^0$ required substantial use of quantitative techniques in order to transform information on the most recently available and useful data (from the pre-2002 period) when Antigua had access to the U.S. gambling market, to a scenario accurately reflecting what Antigua's market access at the time of the arbitration would have looked like in the absence of the WTO-inconsistent U.S. measure.

could be used to help the arbitrators rank (and choose between) them on efficiency grounds, equity grounds, etc. See also the discussion in Sebastian (2008).

²⁵ Indeed, in other potential cases in which the WTO-inconsistent policy is not a complete ban, it may be difficult to obtain Q_x^1 since frequently services data are only reported in values (i.e., $P_x^2 Q_x^1$) and not volumes, which could result in the same sort of formula being applied as what was applied by the arbitrators in *EC – Beef Hormones* discussed above.

As it is clearly spelled out in the arbitrator's report, in order to determine the value of Antigua and Barbuda's internet gambling service exports at the time of the arbitration (2007), the arbitrators needed to use quantitative economic techniques to address and control for market phenomenon such as i) changes in U.S. demand that had taken place since 2002, as well ii) supply-side changes that would have likely taken place given the evolution of the global market for such services such as new competition by other foreign competitors that would have likely eroded Antiguan market share, given the initial level of super-normal profits in the industry and low entry barriers.

3.3 Non-tariff measures on imports that violate national treatment

In addition to traditional trade policy tools, such as tariffs and quotas, governments may impose non-tariff measures that ultimately alter conditions of competition between domestic and foreign producers. Examples include the introduction of new laws and regulations that increase the actual cost of exporting in a way that is differential from the costs facing domestic firms, thus forming some violation of national treatment. While there are many examples of such DSU activity in general, an actual dispute that went to arbitration in this area is the *US-Antidumping Act of 1916* case which involved a U.S. policy which allowed the imposition of treble damages, fines or imprisonment (rather than tariffs) in response to dumped imports. The EC in this case argued that the U.S. piece of legislation caused a "chilling effect" on EC exports to the U.S. How can we evaluate (graphically) the appropriate level of retaliation that the arbitrators should accord in response to national treatment violations?

Just as in the prior two theoretical approaches over tariffs and quotas, assume again an efficient initial trade agreement between the countries. Now assume that after receiving the political shock, the respondent country's only policy tool is not a new tariff or quota, but some new domestic legislation that increases the costs of exporting into the respondent's market. In the central panel in figure 3, which shows the respondent's import demand and the complainant's export supply, this is captured by an upward shift of the export supply curve (from X_x^{*0} to X_x^{*1}), as exporters at the original price are less willing to supply

the respondent's market. In the new equilibrium (E^1) the volume of exports is lower compared to the original situation (from Q_x^0 to Q_x^1), although the price that the exporters receive is now higher (from P_x^0 to P_x^2).

In principle the formulaic approach to determining the appropriate level of the complainant's countermeasure is straightforward, as the reciprocity condition of equation (1) continues to hold. Under this formula, the arbitrators would allow the complainant to retaliate up to the value of loss trade volume calculated at the original export prices, as shown in the shaded area in figure 3. Therefore, in order to implement the formula, the arbitrators would again require information as to the current level of exports (Q_x^1), as well as the counterfactual level of exports (Q_x^0) and the counterfactual export price (P_x^0) under a WTO-consistent regime.

Furthermore, as we similarly observed in the last section on the *EC – Beef Hormones* arbitration and the construction of a WTO-consistent counterfactual for edible beef offal (EBO), this presents an important practical complication. The exact quantification of the effects of national treatment violations relies on an uncertain counterfactual (the inward movement of the export supply of the complaining country). This fact makes the quantification of the appropriate response more complex than the analogous problem in presence of applied measures such as more restrictive import tariffs. Here, the quantification would require information on the size of the non-tariff measure (shifting back the export supply curve) as well as information on the expected import demand elasticity response if that non-tariff measure were removed.

3.3.1 Actual DSU arbitrations over NTMs on imports that violate national treatment: *U.S. – Antidumping Act of 1916*

In this particular dispute, the United States was found to have a piece of domestic legislation – the Antidumping Act of 1916 – that was WTO inconsistent because it permitted the imposition of penalties

that were inconsistent with obligations set out in the WTO's Antidumping Agreement.²⁶ A DSU arbitration thus determined the appropriate level of countermeasures that the EC could impose, finding that it could retaliate up to the level of damages that U.S. courts had imposed on EC firms ("entities") under the 1916 Act as well as settlements agreed to by EC firms being prosecuted under the Act.²⁷

While such a retaliatory determination is unrelated to the reciprocity approach described in the last section, we do point to one particular element of the arbitration that does relate to such an approach. In particular, the EC made the argument to the arbitrators that the U.S. Antidumping Act of 1916 legislation imposed a "chilling effect" on European exporting firms. In the context of our economic model and figure 3, such an effect can be represented as an extra cost facing foreign exporters that is not born by domestic, import-competing firms in the U.S. Thus this piece of U.S. legislation shifts in the EC's export supply curve in figure 3b. Viewed from this perspective, it would be possible theoretically for arbitrators to use the reciprocity formula approach to determine permissible EC retaliation for the trade effects illustrated there.

In practice, of course, it would have been extremely challenging for arbitrators to calculate the trade effects associated with the Antidumping Act of 1916 legislation. Quantification of the chilling effect would require determination of the WTO-consistent counterfactual equilibrium E^0 , and thus the counterfactual export price (P_x^0) as well as the counterfactual level of exports (Q_x^0). In this particular dispute, an accurate assessment would require such a chilling effect calculation on a product-by-product basis for all EC products that had had their exports diminished by such a WTO-inconsistent policy. Individual calculations for thousands of such products likely would make such an approach infeasible to implement in practice. Nevertheless, it should be pointed out that a number that is difficult to calculate is

²⁶ *United States - Anti-Dumping Act of 1916 (Original Complaint by the European Communities) Recourse to Arbitration by the United States under Article 22.6 of the DSU – Decision by the Arbitrators*, WT/DS136/ARB, 24 February 2004.

²⁷ This led to zero retaliation in this instance as there had been no penalties imposed on EC firms, and neither party provided verifiable evidence of settlements involving EC firms that had been prosecuted under the Act. Nevertheless, the arbitrators did allow for future retaliation should such damages be incurred in the future before the U.S. brought the 1916 Act into WTO compliance.

not necessarily equivalent to zero, which is the amount both the arbitrators as well as the two parties quantitatively attached to the chilling effect in the actual arbitration.

3.4 Domestic subsidies to import-competing firms

In this subsection we examine domestic production subsidies. Unlike the export subsidies that are the focus of section 4, domestic production subsidies are not, in principle, a trade-policy measure. However, these kind of government transfers may well have an effect on expected market access to foreign firms that WTO commitments are designed to protect. We illustrate this case in figure 4.

Assume that the government in R departs from an efficient agreement by providing an illegal production subsidy, s , to its import-competing sector. As usual, a political shock such as the increased weight on producers' surplus may rationalize the introduction of the new measure.

How we account for the trade effect of this policy measure is to once again turn to the reciprocity approach.²⁸ Provided the domestic producers utilize at least part of the subsidy to expand domestic supply, as is obviously the case for production subsidies, then we should expect an outward shift of the supply schedule in the respondent's market (from S_x^0 to S_x^1), depicted in panel 4a. In the international market, as the respondent is a net importer of the good, the effect of increased domestic production implies a reduction in import demand from M_x^0 to M_x^1 . In the new equilibrium (E^1) in panel 4b., the export price is lower (from P_x^0 to P_x^1), a terms-of-trade deterioration for the complainant, and the volume of imports is lower (from Q_x^0 to Q_x^1).

Figure 4b. illustrates that the impact of the WTO-inconsistent domestic production subsidy is essentially equivalent in effect to an import restrictive measure such as the import tariff illustrated in figure 1 and described in section 3.1. The impact is that the volume of trade is lower than what it would

²⁸ An important point to note is our assumption that the subsidy to import-competing producers is tied to production. On the other hand, if the transfer is just redistributed lump-sum to share holders, we should not observe any relevant effect on production and trade. However, if domestic producers utilize at least part of the subsidy to expand domestic supply this will affect the import demand curve and reduce market access to the foreign exporting firms.

be if the measure were absent. Under the reciprocity approach, the complainant would be entitled to a level of retaliation equal to the shaded area in panel 4b, once again being allowed to impose a retaliatory tariff that restricts its imports from the respondent under the formula given by equation (1).

3.4.1 Actual DSU arbitrations over domestic subsidies to import-competing firms: U.S. – *Continuing Dumping and Subsidy Offset Act (Byrd Amendment)*

The *U.S. –Byrd Amendment* case involved U.S. firms who had petitioned for antidumping and countervailing measures subsequently receiving the duties collected under the policies. We use the theoretical framework described in the last section to describe the actual arbitration that took place.²⁹

We begin by a brief description of the approach taken by the U.S. which is discussed extensively in the arbitrators' report, which broadly corresponds to the reciprocity approach developed above. The method proposed by the United States to evaluate the appropriate level of retaliation (the shaded area in figure 4b.) contained three substantial points. First, the effect of the remittances on domestic production should be estimated at the product level. Second, the trade effect should be calculated by using estimates of the elasticities of the United State's export supply and of the complaining party's import demand at the product level. Third, the calculation of the appropriate trade sanction needs to result from the sum of these individual values. Based on this model, the U.S. concluded that the trade effect of the WTO-inconsistent measure is null, as the payments did not result in any increase in production. In terms of the figure 4a., this is equivalent to assume that there is no shift in the in the domestic supply curve (from S_x^0 to S_x^1).

Interestingly, arbitrators acknowledged that the model proposed by the United States was well specified (paragraph 3.114). However, arbitrators disagreed with how the U.S. implemented the model based on two fundamental issues. First, the arbitrators felt that the effect of the remittances on domestic production would be generally different from zero. Second, the U.S. had chosen not to implement the

²⁹ *United States – Continued Dumping and Subsidy Offset Act of 2000. Original Complaint by the European Communities. Recourse to Arbitration by the United States under Article 22.6 of the DSU. Decision by the Arbitrators, WT/DS217/ARB/EEC, 31 August 2004.*

model for a number of products covered by antidumping or countervailing duties that the arbitrators felt should have been part of the calculation.

Therefore, while the arbitrators signaled in their report a preference to use an approach that appeared consistent with the reciprocity formula that would be implemented at the product-level, they were constrained to adopting a more aggregated approach that utilizes a less data-intensive methodology. This approach relied on an "economically determined" coefficient (72%) that is then multiplied by the level of the subsidy (see figure 4a. under the assumption that –a fraction of- the remittances worked as a production subsidy) to provide an estimate of the value of loss trade (in figure 4b.). This coefficient is meant to capture the value of the trade effect of the WTO-inconsistent measure: each dollar paid to petitioning firms reduces the value of exports of the complainant by 72 cents. A key issue is, therefore, how such value was calculated in the first place. The broad idea is that the aggregate trade effect would be the product of three elements: the price reduction caused by the payment ("pass-through," in the language of the report), a substitution elasticity of imports and import penetration. Arbitrators used adjusted data provided by the parties to estimate an annual value of the trade-effect coefficient for each year between 2001 and 2003 and calculated the average for the period, which delivers the above figure.

As a final remark, notice that it is difficult to assess whether the actual level of retaliation proposed by the arbitrators is consistent with the reciprocity approach discussed in the previous section. The two levels in figure 4a. and 4b. are related, but can be generally quite different on a product by product basis. The coefficient attempts to average out these effects by providing a single number and is, by construction (and as discussed in the report) an imperfect substitute for a more detailed (i.e., disaggregated) approach. However, notice that the aim of the approach followed by the arbitrators in this case is quite clearly to utilize available data to evaluate the trade effect of the subsidy. As we discuss in the next section, this is not necessarily the case for WTO-inconsistent export subsidies.

4 WTO Disputes and Retaliation over Export-Promoting Measures

We now turn our attention to WTO-inconsistent policy measures that a respondent country R implements that have the effect of excessively promoting exports. Examples of such policies include government transfers to the export sector such as export and production subsidies. As is well understood from the theory of trade policy, these measures have fundamentally different effects on trade volumes and the terms-of-trade when compared to import restraining policies. However, we will show that under certain assumptions – namely, the presence of an export market where both the complainant and the respondent sell their goods - the logic of the reciprocity approach still delivers interesting insights. Absent this assumption, as we discuss in a later section, it is unclear why export promoting policies are a problem in the first place, which suggests that we may need a different model to rationalize existing rules.

4.1 Export subsidies in a three-country model

We begin our investigation of the appropriate value of retaliation for the complainant in case of export promoting policies implemented by the respondent by looking at export subsidies. As shown in Bagwell and Staiger (2001b), the value of a subsidy agreement from the perspective of exporting governments is to avoid a subsidy escalation, where each government is tempted to subsidize its exporters so as to create a competitive advantage in the third market – i.e., a prisoners' dilemma problem.

Once again we begin our analysis with a discussion of the underlying theory. We extend the model of the section 3 that examined import-restricting measures in two important directions. First, we introduce a third good (that we call z) which both the complainant and the respondent export (competitively) to a third country, that we will refer to as the rest of the world (ROW). Second, we allow the governments of countries R and C access to an export promoting policy tool (s) that affects good z , in addition to the tariff policies (τ, τ^*) that they can implement on one another's imports of x and y , respectively. For simplicity, ROW does not use any policies to interfere with trade flows. This framework is a straightforward extension of Bagwell and Staiger (2001b). As in the previous section, we assume to

start from an efficient international agreement which binds the level of policy measures (both import restricting and export promoting). We denote these levels with τ^E, τ^{*E} and s^E, s^{*E} , under the simplifying assumption that they are symmetric across countries and across goods.

Now assume that the government of the respondent country receives a political shock (e.g., increased political weight on exporters' interests), so that it seeks to increase its export promoting policy for sector z to $s^1 > s^E$. The introduction of this new measure in country R will affect the volume of its export of good z to the rest of the world and (as a result of excess export supply) the price of good z in international markets. This, in turn, will reduce market access of country C's producers in ROW as well as the price of their export.

Figure 5a. illustrates this by focusing on the ROW import market for good z from the complainant country only and thus abstracting from the respondent. It portrays ROW's (net) import demand from the complainant (M_z^0) and the export supply from country C (X_z^*). Before the shock in R, the equilibrium is at point E^0 , which implies an export price $P_z^0(s^E, s^{*E})$ and a volume of trade between the complainant and the rest of the world equal to $Q_z^0(s^E, s^{*E})$. The effect of the subsidy in R is to shift downward the import demand curve. Intuitively, the export subsidy in R allows its exporters to supply goods in international markets at a lower price, which reduces the demand for exports from country C. In the new equilibrium, denoted with E^1 , the price received by C's exporters $P_z^1(s^1, s^{*E})$ is lower and the quantity of exports of the complainant into ROW market falls from Q_z^0 to $Q_z^1(s^1, s^{*E})$. This policy change in R hurts the exporting sector in C by lowering its market access in the rest of the world and worsening its terms-of-trade.

We adopt the reciprocity approach to infer the level of retaliation that the complainant is entitled to in response to its loss of market access in ROW. Formally, under the reciprocity approach the complainant is allowed to introduce a retaliatory trade restrictive measure (τ^{*Ret}) on the imports of good y from country R equal to the value of lost trade volumes at original export prices, i.e.,

$$P_z^0(s^E, s^{*E}) [Q_z^0(s^E, s^{*E}) - Q_z^1(s^1, s^{*E})] = P_y^0(\tau^{*E}) [Q_y^0(\tau^E) - Q_y^{\text{Ret}}(\tau^{*Ret})]. \quad (3)$$

At this point we are ready to evaluate the retaliation that the complainant is entitled to under the reciprocity approach. This corresponds to the shaded area in figure 5a. – i.e. the left-hand side of the reciprocity condition above - that is the volume of loss trade for the complainant ($Q_z^0 - Q_z^1$) evaluated at the original export price, i.e., $P_z^0(s^E, s^{*E})$. Just as with import-restricting measures, the reciprocity approach allows for a level of retaliation which preserves a balance of concessions.

Before moving forward, however, we take a moment to compare the effects of export-promoting policies (such as the subsidies of this section) with those of import-restricting measures analyzed in the previous section. Notice that, while the higher export subsidy in R leads to a contraction of trade volumes of the complainant with the rest of the world (as with trade restrictive policies), the *overall* effect on trade of this measure is to *expand* trade volumes. The subsidy thus creates more trade than that which is diverted (this effect is not captured by figure 5a., but it will be obvious in the two-country model that we will study next). For this reason, the terms-of-trade improves for the consuming importers in the rest of the world.

4.1.1 Actual DSU arbitrations over export subsidies and third country effects: *Canada– Aircraft Subsidies, Brazil - Aircraft Subsidies, and U.S. – Foreign Sales Corporations (FSC)*

Before turning to any actual DSU arbitrations over subsidies that fit this framework, it is worthwhile making one additional point regarding GATT/WTO treatment of export subsidies. Under the countervailing duty provisions that have been part of the GATT since 1947, if a foreign government offers a subsidy to exporting firms that leads to injury in a domestic (import-competing) industry, the

government of the import-competing producers can unilaterally impose a countervailing duty. However, the magnitude of the response was limited to be *no larger than the amount of the subsidy*.³⁰

This analysis allows us to reflect on the value of the subsidy as the appropriate level of admissible retaliation in cases of this nature. Consider figure 5b, which presents another illustration of the ROW import market, but this time how it interfaces with the respondent's export supply curve in the face of the respondent country's export subsidy (s^I) which shifts out the X_z^0 curve to X_z^1 . Note that in such a model, the value of the export subsidy is given by the cross-hatched area in figure 5b. On the one hand, it is intuitive to realize that the size of the subsidy is related to its trade effect (a larger subsidy expands R's export supply schedule). On the other hand, however, it is not obvious that the size of the subsidy corresponds to the value of the trade effect. The relationship between these two amounts (the shaded area in panel 5a. versus the cross-hatched area in panel 5b.) ultimately depends on the elasticities of import demand and export supply.

Naturally, one can make an argument, which may be relevant on practical grounds, that the size of the transfer may be easier to calculate than the value of the market access effect. Nevertheless, this is different from the reciprocity formula based on a theoretical approach to understanding the purpose of retaliation from a trade-balancing effect perspective (Bagwell and Staiger, 2002).

Canada– Aircraft Subsidies and Brazil - Aircraft Subsidies

The first two DSU arbitrations that we examine which relate to export subsidies to firms that compete in third markets are the Canada (Bombardier) and Brazil (Embraer) tit-for-tat aircraft subsidy cases.³¹ In the first dispute that Canada brought against Brazil, Brazil was found to have provided WTO-inconsistent export subsidies via its export financing programme for Embraer regional jet aircraft that competed with

³⁰ See, for example, the discussion in Sykes (2005).

³¹ See *Canada - Export Credits and Loan Guarantees for Regional Aircraft - Recourse by Canada to Article 22.6 of the DSU and Article 4.11 of the SCM Agreement - Decision by the Arbitrator*, WT/DS222/ARB, 17 February 2003; and *Brazil - Export Financing Programme for Aircraft - Recourse to Arbitration by Brazil under Article 22.6 of the DSU and Article 4.11 of the SCM Agreement - Decision by the Arbitrators*, WT/DS46/ARB, 28 August 2000.

Bombardier sales in third markets. In the second case, Canada was found to have implemented similar WTO-inconsistent policies – constructed as export credit and loan guarantees – to Bombardier's export sales of regional jets. In terms of timing, the Article 22.6 arbitration in the Brazil case was announced in August 2000, while in the Canada case it was announced in February 2003.

It is instructive to lump together the discussion of these cases not only because they were related (in the sense of one country's WTO-inconsistent export subsidy scheme likely being in existence because of the other country's similar policy), but because the arbitrators' logic in each dispute was similar. The arbitrators did not attempt to implement a reciprocity formula that would follow the trade effects approach that we introduced in the theoretical section. Instead, in each case, the arbitrators sought to establish a permissible level of retaliation commensurate with the size of the export subsidy, i.e., the cross-hatched area of figure 5b given by $s^1 Q_z^1$.³² As we have noted, the size of this area is not necessarily commensurate with the size of the trade effects of the export subsidy – i.e., the volume of loss trade for the complainant ($Q_z^0 - Q_z^1$) evaluated at the original export price, i.e., $P_z^0(s^E, s^{*E})$. While there are a number of potential explanations behind why the arbitrators chose a different formula (the size of the export subsidy) than the reciprocity formula based on the trade impact of the measure,³³ it is also worth pointing out that the arbitrators discussed the trade impact of the subsidies and recognized that it might differ from the size of the actual subsidy itself.³⁴

³² In the arbitration over Canadian subsidies in which Brazil was permitted to retaliate, the arbitrators added 20% to the size of the estimated Canadian subsidy under the argument that "the 'appropriate' level of countermeasures should reflect the specific purpose of countermeasures. Keeping this in mind, we are aware of the view that Canada's statement that, for the moment, it does not intend to withdraw the subsidy at issue suggests that in order to induce compliance in this case a higher level of countermeasures...would be necessary and appropriate." (paragraph 3.107, pp. 30-31).

³³ These would include arguments that the arbitrators pick the size of the subsidy in third market cases because 1) this is the analog to the response under WTO permitted countervailing duty laws in two country models; 2) calculating trade effects in a third market model would require data and elasticities from third country markets (the importer) which does not face the same economic incentive to reign in the use of the subsidies since it benefits from lower import prices when they are in place; 3) for "lumpy" products such as aircraft, it may be difficult to precisely construct the trade impact of an export subsidy, 4) some of these subsidies may have dynamic (long run) effects, especially when they are allocated in markets with high fixed costs of entry.

³⁴ In the *Canada – Aircraft* case, the arbitrators indicated that "We agree in principle with Brazil that, in a market as competitive as the market for regional jets, even a limited difference in interest rates, if it allows a manufacturer to

In terms of implementing the formula that the arbitrators chose, since the only WTO-consistent regime for export subsidies for these aircraft was zero, the only remaining task is to use quantitative economics to compute the size of the subsidies. Computation of the size of the export subsidy in each of the arbitrations appears to have relied on standard techniques from financial economics. The arbitrators in each of the disputes took the basic approach of calculating the total discounted present value of the subsidy based on sales data and information on financing terms (interest rates) provided by the parties.

U.S. – Foreign Sales Corporations (FSC)

The final DSU arbitration that we consider is the retaliation the EC was authorized in regards to U.S. imposition of WTO-inconsistent subsidies in the *U.S.- Foreign Sales Corporation (FSC)* dispute.³⁵ An export subsidy such as that found in the *U.S. – FSC* case has the potential not only to have trade effects on exporting firms from complaining countries in third markets, but it is also quite possible that such a subsidy might also adversely affect the complaining countries' firms' sales in its own domestic market. In this section we limit discussion to the third-market effect and return to the latter effect after having introduced a two-country model of export subsidies in the next section.

Similar to the approach in the two aircraft subsidy disputes the arbitrators' formula for establishing appropriate countermeasures was based on the size of the estimated subsidy that the U.S. gave its firms and not the trade effects embodied in the modified Bagwell and Staiger reciprocity formula.³⁶ Nevertheless, the arbitrators in the *U.S. – FSC* dispute did not rule out consideration of the trade effects approach, although nowhere in the report is there a description of either the parties or the arbitrators considering the formula, counterfactual, or quantitative techniques that would be needed to

win a contract, may have a disproportionate impact, calculated on the basis of the trade impact, compared with the amount of subsidy granted." (paragraph 3.115, p. 32)

³⁵ *United States - Tax Treatment for Foreign Sales Corporations - Recourse to Arbitration by the United States under Article 22.6 of the DSU and Article 4.11 of the SCM Agreement - Decision of the Arbitrator*, WT/DS108/ARB, 30 August 2002.

³⁶ See also the discussion in Howse and Neven (2005).

construct such a countermeasure limit in the same way that we observed and noted in *EC – Bananas*, *EC – Beef Hormones*, or *U.S. – Internet Gambling*, for instance.³⁷

In terms of implementing the formula once it has been decided, the choice of the WTO-consistent counterfactual was relatively straightforward in this dispute since the subsidy was prohibited. Thus, the remaining task for the arbitrators to use quantitative economic techniques to determine the size of the U.S. subsidy. In this particular case it was complicated by a number of factors – including the fact that, like the *U.S. – Byrd Amendment* case discussed above, the subsidy applied to many different firms, sectors, and products. Instead of doing a product-by-product approach to constructing the subsidy from the micro level and aggregating it upward, both of the parties relied on relatively aggregated models to construct estimates of the size of the subsidy – indeed, the EC event presented results based on a model used by the U.S. Treasury Department in an unrelated report it gave to the U.S. Congress in 1997 on the trade effects of the U.S. FSC policy. Nevertheless, in this particular instance, in order to make a decision on the size of the subsidy, the arbitrators were ultimately forced to confront and make assessments on a number of key inputs required to generate output from the models, including the parties' proposed values for "the reduction in the price of the good benefiting from the subsidy; the export response of producers benefiting from the subsidy; and the price elasticity of demand for US exports." (footnote 90, pp. 27-28).

4.2 Export subsidies in a two-country model

Consider again the two-country model of section 3.1, but now assume that in addition to import tariffs, governments have another policy tool in their arsenal in the form of export subsidies. The initial situation corresponds, as before, to an efficient agreement and, in response to a political shock, the government in R increases its export subsidy to domestic producers of good y to the new politically optimal level. As

³⁷ Indeed, the arbitrators state "We...do not rule out a priori that trade effects of the measure on the affected Member can enter into consideration in a particular case, as a relevant factor, in determining the 'appropriate' amount of countermeasures within the meaning of Article 4.10 of the SCM Agreement. Indeed, as we have previously noted, the expression 'appropriate countermeasures', in our view, would entitle the complaining Member to countermeasures which would at least counter the injurious effect of the persisting illegal measure on it." (paragraph 6.33, pp. 25-26).

before, we want to study the effect of this policy change on the volume of trade and on the price, and use this to infer the appropriate level of retaliation under the reciprocity approach.

Figure 6 illustrates the consequences of increased export subsidies in R. As before, the central panel illustrates the equilibrium in the international market. This panel portrays the export supply schedule of the respondent and the import demand schedule of the complainant. Both curves can be obtained (*mutatis mutandis*) with the same methodology described above for the tariff analysis.

The effect of the increased export subsidy is to create incentives for producers in R to export more for any given price, thus shifting downward the export supply schedule in panel 6b from X_y^0 to X_y^1 . As a result, an excess-supply is created in the international (and the complainant's) market and an excess-demand in country R, this imbalances cause the price to fall in the international and the complainant's market (from P_y^0 to P_y^1) and to increase in the domestic market of the respondent (from P_y^0 to P_y^2), which in turn implies a higher quantity of exports (from Q_y^0 to Q_y^1).³⁸

The fundamental implication of the policy change is that the respondent *increases* its market access in the international market (i.e., in country C's import market) at the expense of producers in the complainant country. We can now use the figure to obtain the level of retaliation that the complainant is entitled to under the reciprocity approach – panel 6b. illustrates this as equal to the volume of trade distorted relative to the initial agreement ($Q_y^1 - Q_y^0$) calculated at original export price (P_y^0). This area is shaded in panel 6b. and is equal to each of the shaded areas in panel 6a. and 6c. Note finally in panel 6b. how, just in the three country model export subsidy case derived in the last section, there is not necessarily an equivalence between the size of the value of the export subsidy (the cross-hatched rectangle) and the trade effect under reciprocity (the shaded rectangle).

³⁸ Even if in our notation (both in the text and in the figure) we do not show functional arguments, the reader should keep in mind that, relative to section 3, prices and quantities are now function of both tariffs *and* subsidies.

While the intuition of the reciprocity approach remains unaltered in this model of export subsidies vis-à-vis the model with import-restraining policies – i.e., the appropriate retaliation is the one that stabilizes the value of exports and imports trade volumes between countries – this theoretical case also identifies an important limitation. A major departure from the previous subsection, in which the complainant experienced a *negative* terms-of-trade effect as a consequence of the higher export subsidy in the respondent, is that the complainant experiences a *positive* terms-of-trade effect in the two-country model. From perspective of pure social welfare, it is well understood that the subsidy lowers welfare for the respondent and increases welfare for importing country C. From an aggregate welfare sense, the complainant should have little to complain about.

4.2.1 Actual and potential DSU arbitrations over export subsidies in a two-country model: U.S. – Foreign Sales Corporations (FSC)

This discussion on WTO-inconsistent subsidies in two-country models suggests a novel reflection on the U.S. – FSC case. As observed in section 4.1.1 and shown above, this form of export subsidy has the potential to adversely affect the complaining countries' firms' sales in its own domestic market in addition to any third-market effect. For example, this would be the case if these firms are multi-product firms that produce different varieties of related products, an export subsidy by the respondent may affect the complainants' sales in a third country export market as well as its own domestic market. Thus, while the theoretical case in this section is often thought to be most easily and efficiently dealt with outside of a DSU case via the use of (WTO-permitted) countervailing measures, in the case that export subsidies have a trade effect in both third markets and domestic markets, there may be some efficiency arguments for consideration of all of these elements together in one DSU proceeding.

5 Other Issues

In the remaining sections, we look at issues that are also potentially important but that we could not address with the theoretical models presented thus far.

5.1 Imperfectly competitive markets: strategic trade policy

Thus far, each of our models have assumed that firms trade in perfectly competitive markets. Given that the two arbitrations over export subsidies between Canada and Brazil clearly involve aircraft-producing firms (Bombardier and Embraer) that compete in imperfectly competitive markets, we present a simple refinement of the underlying model in this section to check on the sensitivity of our results.

As discussed in the strategic trade policy literature, when export markets are not competitive, an export subsidy can be appealing to the exporting firm's government for reasons that are independent of any political economy motive. The classic example is Brander and Spencer (1985), who present a model with many of the same characteristics of the three-country model of section 4. Brander and Spencer's primary departure from section 4's model is that there are only two firms - i.e., one in the respondent and one in the complainant - and the exporting market in ROW where producers compete is thus not competitive, but is assumed to have a Cournot oligopolistic market structure. Notwithstanding these differences, the effects of an export subsidy in this environment are remarkably similar to the ones just discussed in the previous section. A key insight is that such subsidies can represent a means through which a government can give to its exporters an advantage and thus shift profits in a imperfectly competitive environment. If only one government uses such a subsidy, it can change the nature of the game to one in which its subsidy policy credibly commits its firms to a production level that effectively give it a first-mover (Stackelberg leadership) advantage. Of course, if both governments have access to such subsidies, both may implement them and the result is a prisoner's dilemma outcome in which both would be better off if both removed the subsidies, but neither country has a unilateral incentive to do so. Hence from these two countries' perspective, there is an incentive to craft a subsidy limitation agreement to help them jointly escape the prisoner's dilemma outcome.

Therefore, assume we begin with such a (bilaterally) "efficient" export subsidy agreement and that government R suddenly increases the subsidy to its firm. What are the effects on the trade volume between country C and the rest of the world? What is the appropriate level of retaliation that an arbitrator

should allow under the reciprocity approach? Just as was the case in the earlier export subsidy model of perfect competition, the effect of a subsidy is to reduce the effective import demand of the ROW faced by the producer in C. As depicted in figure 5, the downward shift of import demand in world markets leads to a contraction of export volumes for the complainant's firm. Under the reciprocity condition, the level of retaliation corresponds to the shaded area in figure 5.

Independently of the mode of competition in export markets, export subsidies in one country distort trade flows against exporters in the other country and to the advantage of the beneficiaries. This results in a negative terms-of-trade effect for the complainant.

Nevertheless, it is still the case that the overall outcome of export subsidies is an increase in trade volume and a terms-of-trade (and welfare) improvement for the importing country, ROW. This positive effect is particularly strong in the case of oligopolistic markets where, notably, firms have an incentive to keep the level of production inefficiently low to boost their profits. In short, in this set of models export subsidies may well lead to a welfare improvement for the world as a whole. This reinforces the idea expressed elsewhere that we may need a different theoretical framework to analyze agreements that limit export subsidies.³⁹

5.2 Non-political shocks

In this subsection we remove a second assumption of the model, the presence of a political shock in country R, and consider how our analysis would change if the respondent was experiencing a non-political shock such as a technology or a demand shock. The main question that we need to address is whether the evaluation of the appropriate retaliation under the reciprocity approach would be substantially different in presence of other types of shocks.⁴⁰

³⁹ See the discussions in Bagwell and Staiger (2006, 2001b). Furthermore, see Ossa (2008) who presents an alternative theory of trade agreements when markets are imperfectly competitive.

⁴⁰ Note that a similar analysis could be done for the equally important case of foreign (positive) technology shocks which expand market access but may, at the same time, endogenously induce the imposition of new trade barriers to

To illustrate this case we use our graphs that represent the market for good x in the two-country model with import tariffs (discussed in section 3.1). Figure 7 depicts the case of a negative technology shock to the import sector in country R. We again assume that we start from an efficient trade agreement in which tariffs are initially bound at τ^E, τ^{*E} , which implies an equilibrium in international markets in panel b. at E^0 , where the export price is P_x^0 and the corresponding volume of trade is Q_x^0 . The negative technology shock in R causes a reduction in domestic supply and thus an inward shift of the supply curve from S_x^0 to S_x^1 . This leads to a flatter respondent import demand curve (from M_x^0 to M_x^1) in the international market. The post-shock equilibrium in panel 7b. is denoted with E^1 and corresponds to a higher export price P_x^1 and volume of trade Q_x^1 . Intuitively, the negative technology shock reduces domestic supply in country R and thus creates an excess demand of the good in the international market, which results in a higher price and larger imports.

In the context of this model and our discussion thus far, the supply shock has not resulted in anything that would result in a WTO disputes, as we have assumed that R's government did not make any policy changes in response to the shock. With no government policy response, there would be no dispute, as country C's market access and its terms-of-trade have improved in the face of the shock. However, there are important reasons to believe that government R may intervene to respond to an adverse technology shock. One possibility is that the import-competing producers of good x negatively affected by the shock increase lobbying pressure on the government, which responds by increasing its politically optimal tariff from the WTO binding of τ^E to some level τ^1 that, while non-prohibitive, violates its WTO commitments.⁴¹ Notice that this is not a political shock, as the preferences of the government (i.e., the weights on producers' surplus versus consumer welfare) have not changed. Absent the supply shock,

in response. The question of the permissible level of retaliation in the face of these two events (foreign shock and new domestic trade barrier) will also arise in such a setting.

⁴¹ For a formal political economy model that shows why declining industries can be particularly effective in receiving protection from the government, see Baldwin and Robert-Nicoud (2007).

the policymaker would have not changed its policy. However, the practical effect of such a shock is not different, as both a political and a technology shock may well result in an increase of a trade-restricting measure. In what follows, we first study the effects of the higher tariff on market access in the context of a negative technology shock and then discuss the issue of appropriate retaliation.

A new (and higher) tariff in country R causes a contraction of market access and a negative terms-of-trade effect for the complainant similar to what we observed in figure 1 and discussed in section 3.1. More precisely, the higher tariff increases the domestic price of the good in R and reduces the import demand of the respondent from M_x^1 to M_x^2 in panel 7b. In the new equilibrium E^2 , imports fall from Q_x^1 to Q_x^2 and the export price is at the lower level P_x^2 . Notice that in the figure, market access for the complainant is not only reduced compared to equilibrium in the absence of the tariff increase in the respondent, but also relative to the pre-shock situation.⁴²

We now turn to the key issue: what is the appropriate level of retaliation under the reciprocity approach? The answer to this question is not trivial and we do not attempt to provide an exhaustive answer. We limit ourselves to that important theoretical insight there are two extremes which can be used to establish the range of possibilities under such an approach. A first option is to consider only the effect of the tariff (as we did in the case of a political shock). In this case the value of loss trade evaluated at initial export price corresponds to the rectangle $(Q_x^1 - Q_x^2)P_x^1$ in panel 7b. This option, however, neglects that the tariff increase was triggered by a negative supply shock in R (which increased market access for producers in country C) and, therefore, may overestimate the prejudice to the complainant. Accordingly, a second possibility would be to look at the pre-shock equilibrium and assess the value of loss trade induced by a higher tariff relative to that counterfactual. This would suggest a smaller admissible retaliation for the complainant equal to the area $(Q_x^0 - Q_x^2)P_x^0$ (i.e. the shaded area in panel 7b.). Notice, however, that in the special case in which the new equilibrium falls in between the pre and the post-shock

⁴² This is not necessarily the case as there is also a special case in which the new equilibrium falls between the pre and the post-shock equilibrium.

situation, this implies that the admissible retaliation for the complainant would be null. Hence, the risk here may be to underestimate the prejudice caused by WTO-inconsistent policy actions.

6 Conclusions

The Dispute Settlement Understanding (DSU) gives WTO arbitrators the mandate to establish the permissible retaliation limits that aggrieved complainant countries in disputes can implement and thus which ultimately serve to enforce the overall WTO agreement. We examine how WTO arbitrators have used and can use theoretical and quantitative economic analysis in this stage of the DSU process for the ten disputes that have reached the stage of arbitration to date.

We organize the analysis by adopting the Bagwell and Staiger interpretation of the WTO principle of reciprocity to provide a theoretical framework that arbitrators can apply to identify the maximum level of retaliatory countermeasures. We identify, characterize, and categorize the major classes of disputes – e.g., those affecting import protection versus export promotion – that typically occur under the WTO and the implications of the Bagwell and Staiger approach for each type of likely dispute. We then analyze each of the ten DSU arbitrations that have taken place thus far by comparing the arbitrators' actual approach with the theory.

Our framework also allows us to identify three crucial elements to the arbitrators' decision-making process for each case: i) the formula that they decide to adopt for identifying appropriate countermeasures, ii) their political-legal-economic decision on a WTO-consistent counterfactual to use to implement the formula, and iii) the quantitative methods they use to necessarily construct the (unobserved) WTO-consistent counterfactual.

In many of the DSU cases that we examine, such as the arbitrations over WTO-inconsistent quantitative restrictions that limit imports, the arbitrators' actual approach appears quite consistent with the Bagwell and Staiger reciprocity formulation theory. Furthermore, in a number of other cases, the arbitrators' report explicitly signals their preference to use such an approach despite the practical inability to do so for procedural, computational, or data limitation reasons related to the quantitative methods they

are forced to employ in practice. Even in the arbitrations over WTO-inconsistent subsidies in which the arbitrators have departed from the trade effects approach to establishing retaliation limits in favor of a number that is arguably easier to calculate (i.e., the size of the subsidy), using theory to analyze the retaliation determination question allows us to compare the arbitrators' actual approach to one that might occur under this particular formulation of reciprocity. Finally, in the disputes in which this reciprocity approach has not been used, we identify procedural difficulties that arbitrators confront thus highlighting the constraints that hinder their use of economic analysis in practice.

References

- Anderson, Kym (2002) "Peculiarities of Retaliation in the WTO Dispute Settlement," *World Trade Review* 1(2): 123-134.
- Armington, Paul S. (1969) "A Theory of Demand for Products Distinguished by Place of Production," *IMF Staff Papers* 16(1): 159-177.
- Bagwell, Kyle and Robert W. Staiger (1999) "An Economic Theory of GATT," *American Economic Review* 89 (1): 215-248.
- Bagwell, Kyle and Robert W. Staiger (2001a) "Reciprocity, Nondiscrimination and Preferential Agreements in the Multilateral Trading System," *European Journal of Political Economy* 17 (2): 281-325.
- Bagwell, Kyle and Robert W. Staiger (2001b) "Strategic Trade, Competitive Industries and Agricultural Trade Disputes," *Economics and Politics* 13(2): 113-128.
- Bagwell, Kyle and Robert W. Staiger (2002) *The Economics of the World Trading System*. Cambridge, MA: MIT Press.
- Bagwell, Kyle and Robert W. Staiger (2006) "Will International Rules on Subsidies Disrupt the World Trading System?" *American Economic Review* 96 (3): 877-895.
- Bagwell, Kyle, Petros C. Mavroidis and Robert W. Staiger (2002) "It's a Question of Market Access" *American Journal of International Law* 96 (1): 56-76.
- Baldwin, Richard and Frederic Robert-Nicoud (2007) "Entry and Asymmetric Lobbying: Why Governments Pick Losers," *Journal of the European Economic Association* 5(5): 1064-1093.
- Bernstein, Jason and David Skully (2003) "Calculating Trade Damages in the Context of the World Trade Organisation's Dispute Settlement Process," *Review of Agricultural Economics* 25(2): 385-398.
- Bown, Chad P. (2002) "The Economics of Trade Disputes, the GATT's Article XXIII and the WTO's Dispute Settlement Understanding," *Economics and Politics* 14(3): 283-323.
- Bown, Chad P. (2004) "Trade Disputes and the Implementation of Protection under the GATT: An Empirical Assessment," *Journal of International Economics* 62(2): 263-294.
- Bown, Chad P. (this volume) "The WTO Secretariat and DSU Support to Panels and Arbitrations: Lawyers, Economists, Economics, and Law," June 2008.
- Brander, James A. and Barbara Spencer (1985) "Export Subsidies as International Market Share Rivalry," *Journal of International Economics* 17: 83-100.
- Breuss, Fritz (2004) "WTO Dispute Settlement: An Economic Analysis of Four EU-US Mini Trade Wars," *Journal of Industry, Competition and Trade* 4(4): 275-315.
- Francois, Joseph F. and Kenneth A. Reinert, eds. (1997) *Applied Methods for Trade Policy Analysis: A Handbook*, Cambridge: Cambridge University Press.

- Gawande, Kishore and Pravin Krishna (2003) "The Political Economy of Trade Policy: Empirical Approaches," in E.K. Choi and J. Hartigan, eds., *Handbook of International Trade*, Volume I, Basil Blackwell, Oxford, UK.
- Horn, Henrik and Petros C. Mavroidis (2007) *WTO Case Law: Legal and Economic Analysis*, The American Law Institute, Cambridge University Press, Cambridge, UK.
- Howse, Robert and Robert W. Staiger (2005) "United States – Antidumping Act of 1916 (Original Complaint by the European Communities) – Recourse to Arbitration by the United States under Article 22.6 of the DSU," *World Trade Review* 4(2): 295-316.
- Irwin, Douglas A. (2003) "Causing Problems? The WTO Review of Causation and Injury Attribution in US Section 201 Cases," *World Trade Review* 2(3): 297-325.
- Keck, Alexander (2004) "WTO Dispute Settlement: What Role for Economic Analysis?," *Journal of Industry, Competition and Trade* 4(4): 365-371.
- Kelly, Kenneth (1988) "The Analysis of Causality in Escape Clause Cases," *Journal of Industrial Economics* 37(2): 187–207.
- Olson, Mancur (1965) *The Logic of Collective Action*. Cambridge, MA: Harvard University Press.
- Ossa, Ralph (2008) "A 'New Trade' Theory of GATT/WTO Negotiations," LSE manuscript, May.
- Pauwelyn, Joost (this volume) "Damage Calculation in Context: What is the Goal of WTO Remedies?," June 2008.
- Prusa, Thomas J. and David C. Sharp (2001) "Simultaneous Equations in Antidumping Investigations," *Journal of Forensic Economics* 14(1): 63-78.
- Sebastian, Thomas (this volume) "Proportionality Assessment under Article 22.6: The State-of –Play from a Legal Perspective," June 2008.
- Sykes, Alan O. (2003) "The Safeguards Mess: A Critique of WTO Jurisprudence," *World Trade Review* 2(3): 261-295.
- Sykes, Alan O. (2005) "The Economics of WTO Rules on Subsidies and Countervailing Measures," in A. Appleton, P. Macrory & M. Plummer eds., *The World Trade Organization: Legal, Economic and Political Analysis*, Vol. II, Springer Verlag.
- Sykes, Alan O. (this volume) "Optimal Sanctions in the WTO: The Case for Decoupling," June 2008.
- World Trade Organization (2005), "Quantitative Economics in WTO Dispute Settlement," in *World Trade Report 2005*, 171-212.

Table 1: Arbitration cases in the WTO, 1995-2008

Case Title	Agreements/Provisions Infringed	Award by the Arbitrators	Discussed in Section
<i>Import-restricting measures</i>			
<i>EC—Bananas III (US) (Article 22.6 – EC)</i>	GATT Art. XIII	\$191.4 million	3.2
<i>EC-Bananas III (Ecuador) (Article 22.6 – EC)</i>	GATT Art. XIII	\$201.6 million	3.2
<i>EC-Hormones (US) (Article 22.6 – EC)</i>	SPS Agreement	\$116.8million	3.2
<i>EC-Hormones (Canada) (Article 22.6 – EC)</i>	SPS Agreement	C\$11.3 million	3.2
<i>US-1916 Act (EC) (Article 22.6 – US)</i>	GATT Art. VI, Antidumping Agreement	no specific amount	3.3
<i>US-Continuing Dumping and Subsidy Offset Act (Byrd Amendment) (Brazil, Canada, Chile, EC, India, Japan, Korea, Mexico) (Article 22.6 – US)</i>	GATT Art. VI, Antidumping Agreement, SCM Agreement	0.72 * value of payments	3.4
<i>US-Gambling (Article 22.6 – Antigua)</i>	GATS Art. XVI	\$21 million	3.2
<i>Export-promoting measures</i>			
<i>Brazil-Aircraft (Article 22.6 – Brazil)</i>	SCM Agreement	\$344.2 million	4.1 and 5.1
<i>Canada-Aircraft Credits and Guarantees (Article 22.6 – Canada)</i>	SCM Agreement	C\$247.796 million	4.1 and 5.1
<i>US-FSC (Article 22.6 – US)</i>	SCM Agreement	\$4.043 billion	4.1 and 4.2

Figure 1. Reciprocity Compensation when the Respondent Implements a WTO-Inconsistent Tariff

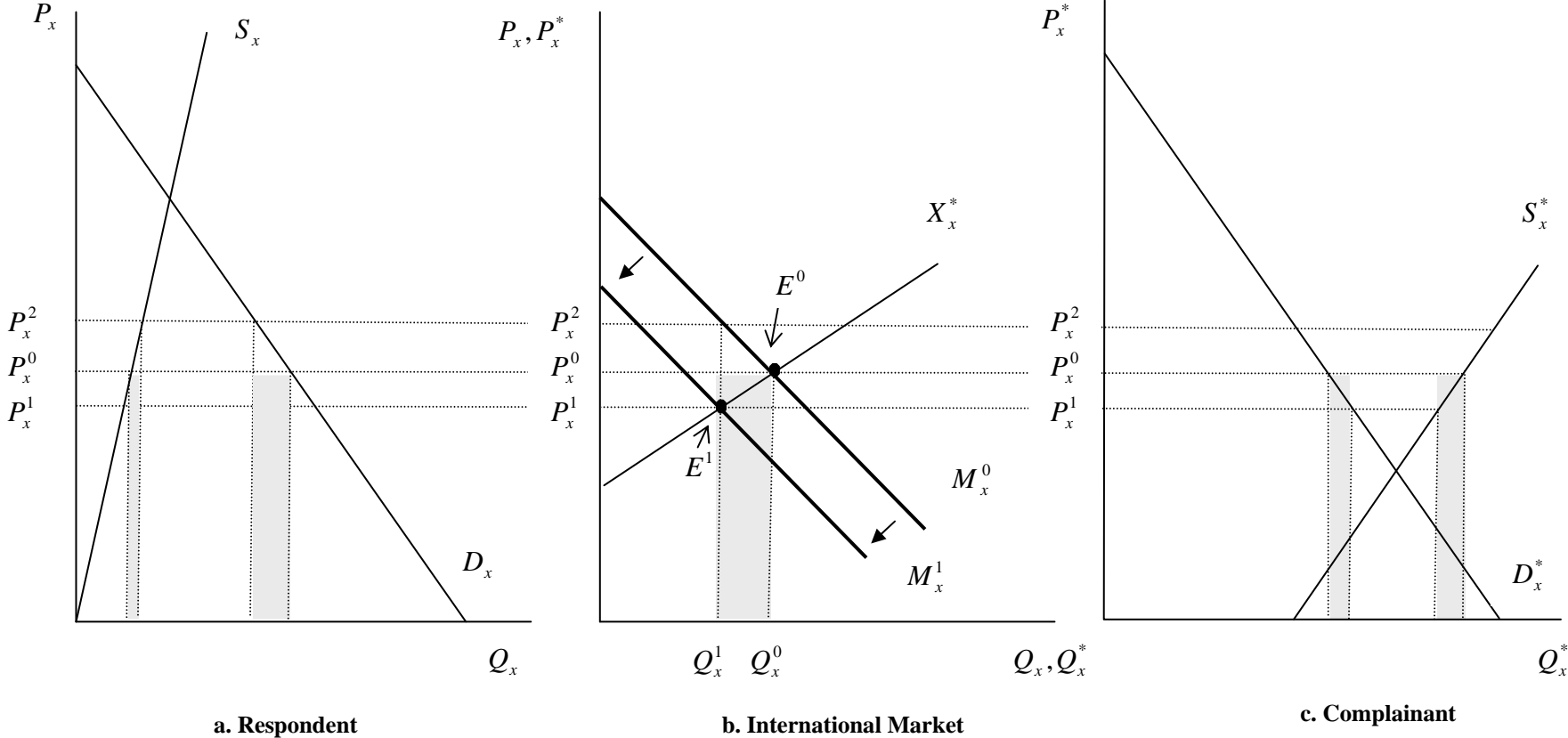


Figure 3. Reciprocity Compensation when the Respondent Imposes a WTO-Inconsistent Non-Tariff Measure on a Trading Partner's Exports (e.g., Violating National Treatment)

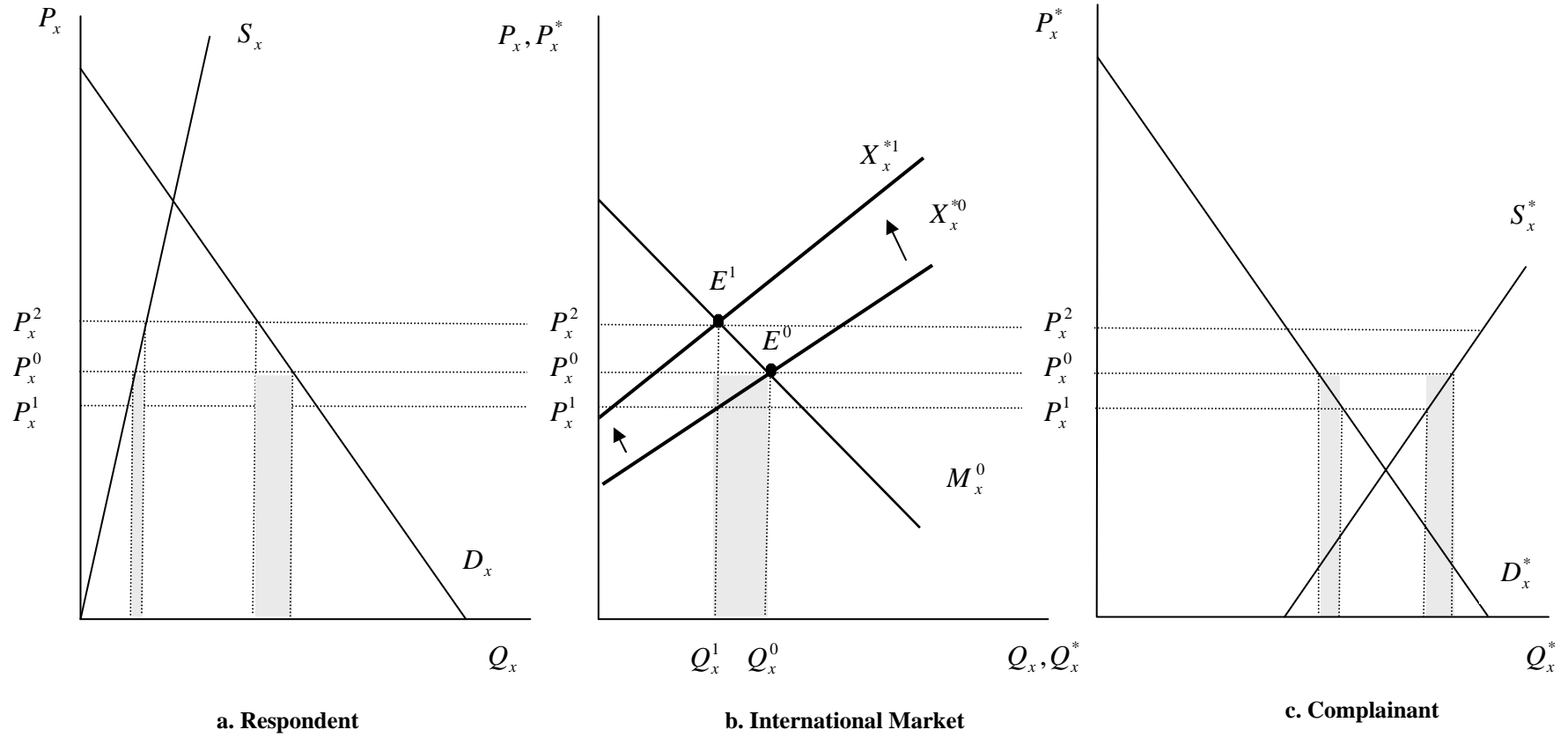


Figure 4. Reciprocity Compensation when the Respondent Implements a WTO-Inconsistent Production Subsidy to an Import-Competing Industry

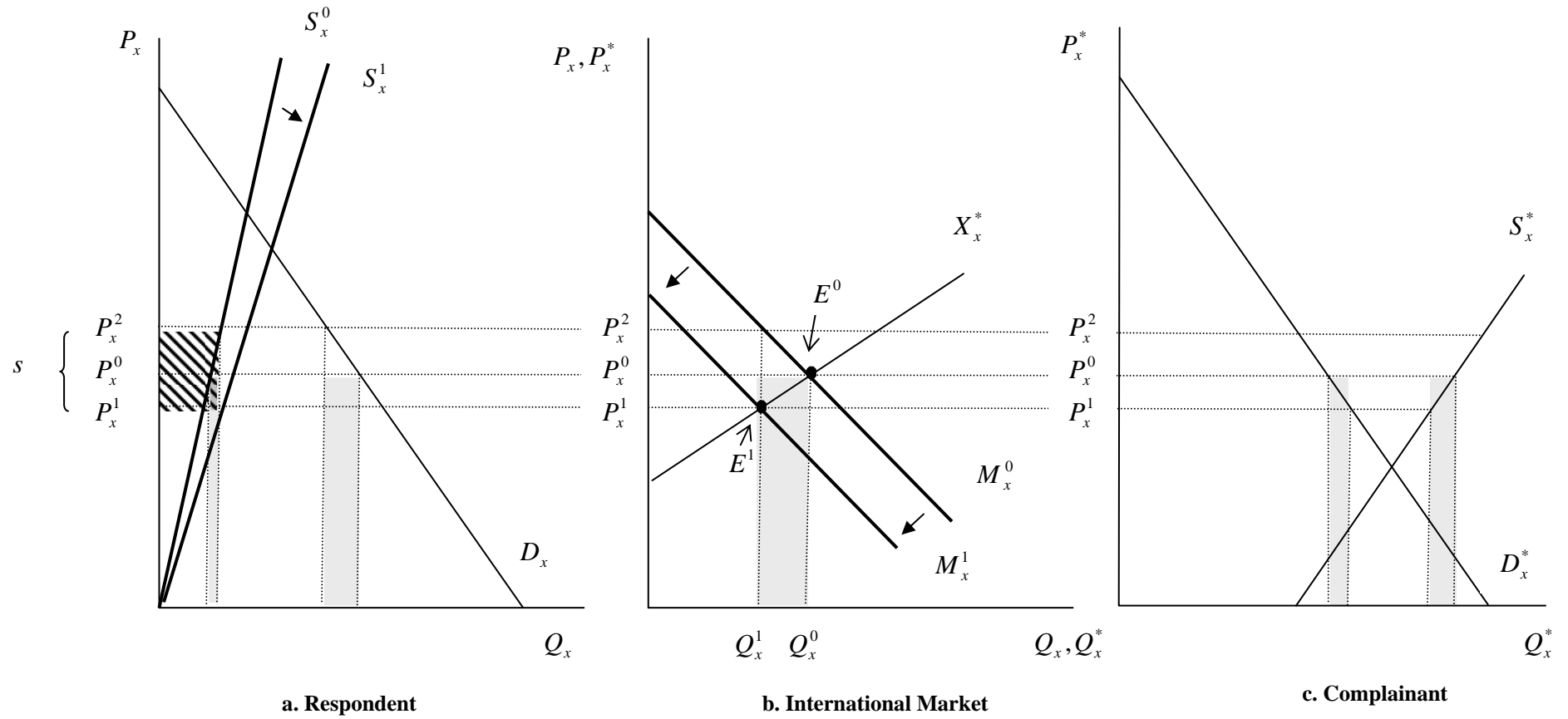
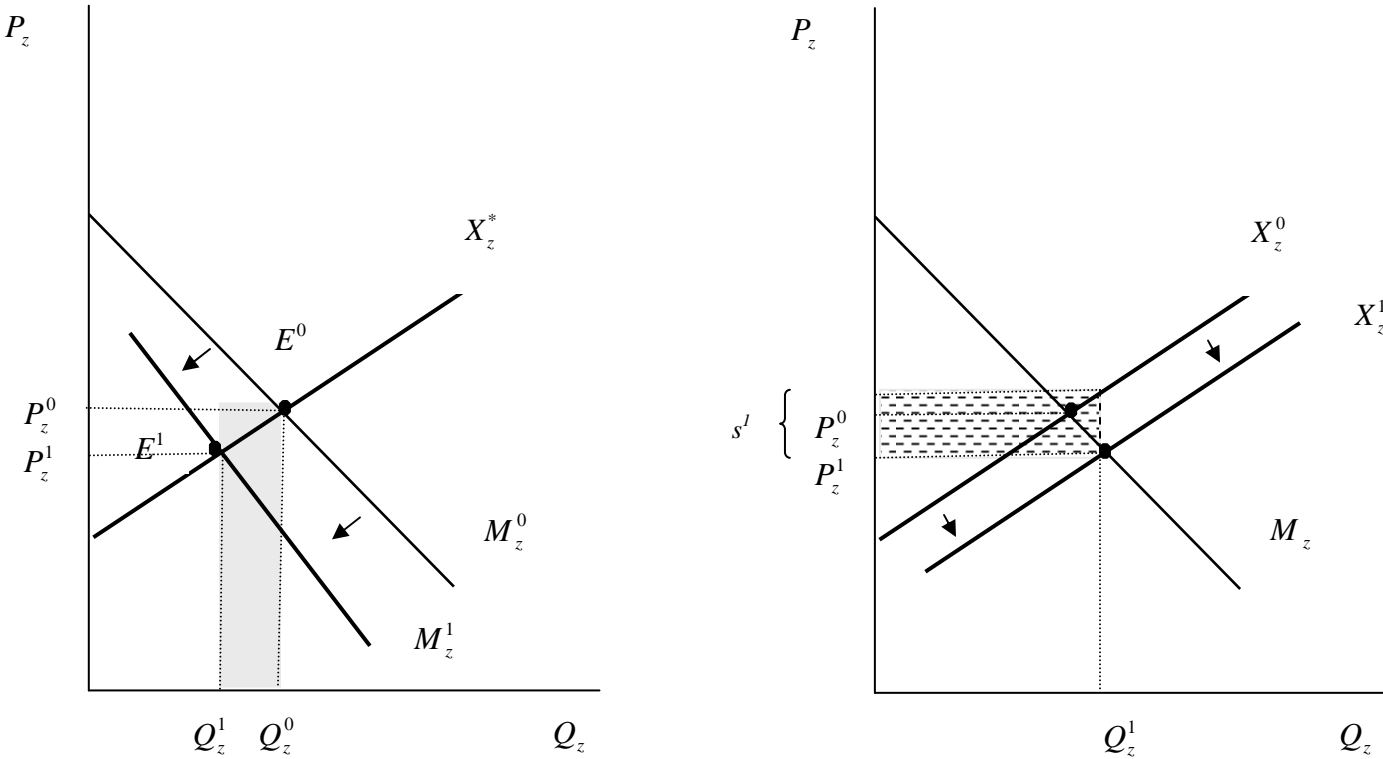


Figure 5. Reciprocity Compensation when the Respondent Imposes a WTO-Inconsistent Export Subsidy (Three-Country Model)



**a. International Market –
ROW Imports from Complainant in
face of Respondent subsidy**

**b. International Market –
ROW Imports from
subsidizing Respondent**

Figure 6. Reciprocity Compensation when the Respondent Imposes a WTO-Inconsistent Export Subsidy (Two-Country Model)

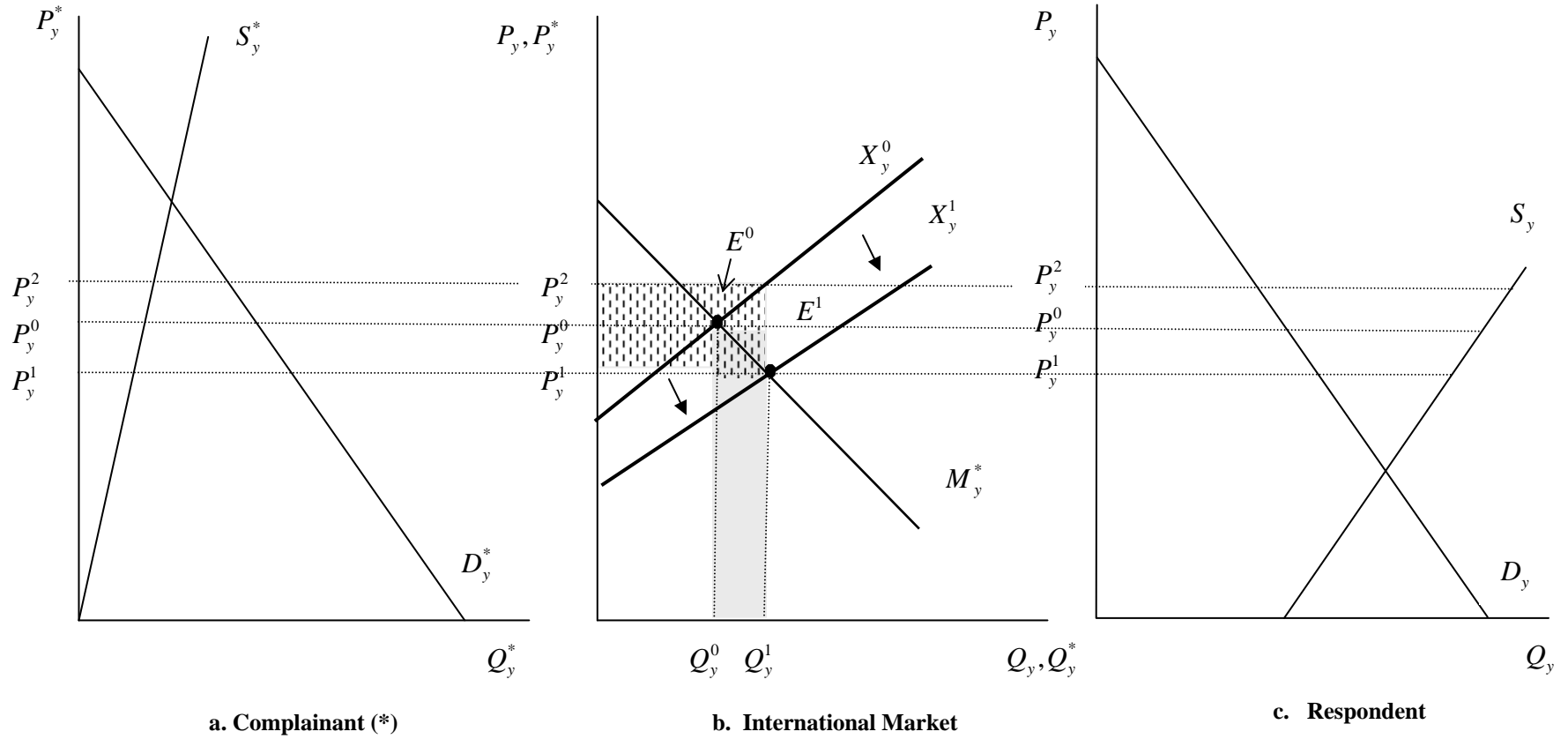


Figure 7. Reciprocity Compensation when the Respondent Implements a WTO-Inconsistent Tariff After a Supply Shock

