Trade Agreements and Enforcement:

Evidence from WTO Dispute Settlement

Chad P. Bown*
The World Bank and CEPR

Kara M. Reynolds†
American University

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Abstract

This paper examines implications of the terms-of-trade theory for the enforcement of international agreements. Like original trade agreement negotiations, we model formal trade *dispute* negotiations as potentially addressing the externality problem that governments implement import protection above the globally efficient level so as to shift some of the policy's costs onto trading partners. We first extend the Bagwell and Staiger (1999, 2011) model from trade agreement accession negotiations to the setting of enforcement negotiations, and the resulting theory guides our empirical assessment. We use instrumental variables to estimate the model on information from trade volume outcomes deriving under WTO disputes that took place over 1995-2009. Our evidence is consistent with theoretical predictions that larger post-dispute import volumes are associated with products that have larger pre-dispute import volumes, smaller increases to foreign exporter-received prices, larger import demand elasticities, and smaller foreign export supply elasticities. While the results hold even after extending the model to address potential country-level bilateral retaliation capacity asymmetries, our evidence does not extend beyond disputes involving high-income WTO member countries and certain types of policy changes that trigger the disputes.

Keywords: trade agreements, terms of trade, WTO, dispute settlement

*Development Research Group, Trade and International Integration (DECTI); The World Bank, 1818 H Street, NW, MSN MC3 303, Washington, DC 20433 USA; Tel: +1.202.473.9588, fax: +1.202.522.1159, email: cbown@worldbank.org

†Department of Economics, American University; 4400 Massachusetts Avenue, NW, Washington, DC 20016 USA; Tel: +1.202.885.3768, fax:+1.202.885.3790, email: reynolds@american.edu

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1 Introduction

What do the enforcement provisions of international trade agreements deliver? Dispute settlement under agreements like the WTO is most frequently triggered when one party to the agreement is alleged to provide import protection above the limit to which it had agreed in prior negotiations. However, the emergence of evidence that the terms-of-trade theory helps to explain policy changes that take place as the outcome of original trade agreement negotiations - whether through accessions or negotiating rounds - raises the question of what, if anything, shapes the negotiated outcome arising under subsequent use of the agreement's enforcement provisions. Put differently, after a government policy deviation disturbs the originally negotiated trade agreement outcome by moving trade volumes away from globally efficient levels and triggering a dispute, does the terms-of-trade theory also help explain the negotiated dispute settlement outcome that arises?

The purpose of this paper is to empirically examine the determinants of the outcomes of formal enforcement negotiations that take place under WTO dispute settlement. Like original trade agreement negotiations, we model formal trade dispute negotiations as potentially confronting the externality problem that arises when a government deviates from the originally negotiated outcome by implementing import protection above the globally efficient level so as to shift some of the policy's costs onto trading partners. Our specific approach to the examination of subsequent dispute resolution is motivated by the combination of two insights from the existing literature on trade agreements and dispute settlement.

First, in an influential paper in the terms-of-trade literature, Bagwell and Staiger (1999) provide a theory-based interpretation of the GATT/WTO principle of *reciprocity* and its implications for how original trade agreement negotiations move countries from a prisoner's dilemma to a jointly efficient outcome. They find reciprocity can serve to coordinate two large countries' tariff changes in a way that neutralizes the otherwise negative (own) terms-of-trade impact that would take place if each country were to implement the same policy change unilaterally. Bagwell and Staiger (2011) derive formal implications for econometric estimation and provide product-level evidence from 16 countries consistent with the theory that negotiated tariff levels resulting from accession to the WTO agreement are related to pre-negotiation import volumes and trade elasticities.

Second, Bown (2002) and others have noted that WTO jurists have *interpreted* the agreement's dispute settlement rules for renegotiation (or retaliation) almost identically to how Bagwell and Staiger (1999) model the reciprocity principle that drives GATT/WTO liberalization negotiations. The WTO limits authorized retaliation in dispute settlement negotiations to a level that - when viewed through the lens of the Bagwell and Staiger modeling framework - should neutralize the terms-of-trade gain of the respondent (importing) country's WTO violating unilateral policy change that is the subject of the dispute.

The empirical question at the heart of this paper is whether evidence of the terms-of-trade theory arising from the original trade agreement negotiations setting (Bagwell and Staiger, 2011) also extends to the trade agreement's *enforcement* negotiations setting. While we begin with their theoretical model, we are forced to adapt its empirical implementation in order to address shortcomings in observability of data that arises in the enforcement setting. For whereas Bagwell and Staiger's examination of tariff negotiations had access to data on "best response" and "politically optimal" *tariff* levels, the enforcement setting typically does not allow for direct observation of best response policies.[1]

Most WTO violations that trigger disputes are not imposed as straightforward changes to tariffs; instead they are typically implemented through nontariff policies, the sizes of which are notoriously difficult to measure accurately. We must therefore first reinterpret the theory to account for what we can better observe and measure, which is data on best response and politically optimal *trade volumes* and *prices*.[2] Put differently, in order to examine whether the predictions from the terms-of-trade theory also extend to determinants of outcomes under trade agreement enforcement negotiations, we do not attempt to assess the impact of these determinants on the changes to the levels of the *policies* themselves, but instead to the changes in the trade volumes that result from these policy choices.

To fix ideas, consider Figure 1, which presents the time path of the mean growth of

[1] In the Bagwell and Staiger (2011) trade agreement negotiations setting, the best response policy was the tariff the country implemented before its WTO accession negotiations, and the politically optimal policy was the negotiated tariff *after* the country had acceded to the WTO. In the trade dispute setting that we introduce below, the best response policy will be the policy that is imposed that triggers the WTO dispute, whereas the politically optimal policy is the one imposed by the importing country after the conclusion of the formal WTO dispute.

[2] Our approach is to impose sufficient structure on the estimation and additional controls to address other factors outside of the model that may also influence trade volumes and prices of disputed products within the period of the dispute.

import volumes and (foreign) exporter-received prices for the products under WTO dispute normalized around two critical years. The first year is one in which the importing country - i.e., the defendant or "respondent" country alleged to have violated WTO rules by imposing an illegal trade restriction - has its best response ($t = BR$) policy imposed. Relative to two years earlier ($t = BR - 2$), the policy is associated with a sharp reduction in import volumes, on average, and a modest reduction in the prices received by the foreign exporter - i.e., the plaintiff or "complainant" in the dispute. On the other hand, two years after the conclusion of the WTO dispute, and by the time the importing country is supposed to have implemented its politically optimal ($t = PO$) trade policy, import volumes have increased, on average, as has the average price received by foreign exporters of the disputed product. Our approach uses model predictions from the terms-of-trade theory to explain the variation in the data underlying Figure 1.

In particular, we derive a formal estimation equation directly from the underlying theory and investigate empirically its relevance for the enforcement of international agreements and the negotiated outcomes that arise under dispute settlement. We use instrumental variables to estimate the model on data from formal WTO disputes that were initiated and concluded between 1995 and 2009 that involve alleged violations over policies that affect goods imports. We present evidence that larger trade volume outcomes are associated with disputed products with larger pre-dispute import volumes, smaller increases to foreign exporter-received prices, and a higher ratio of import demand to export supply elasticities. Furthermore, these results continue to hold even after extending the model to account for bilateral asymmetries in retaliation capacities across the litigating countries.

However, our evidence that the terms-of-trade theory can help explain dispute settlement negotiation outcomes does not extend to all settings, and we show explicitly where the results break down, although much of this breakdown accords with other insights from the literature. For example, while there is particularly strong evidence for disputes involving high-income countries, the framework performs less well in explaining the dispute settlement outcomes for cases involving *developing* countries. This result is consistent with the literature suggesting that governments in developing countries may be more likely to rely on trade agreements for commitment reasons vis-a-vis relationships with their private sectors (Maggi

and Rodriguez-Clare, 1998; Limão and Tovar, 2011) and not for the purpose of neutralizing the terms-of-trade impact of policy choices. Related evidence from other settings also finds that the WTO institution may have strong differential effects on the trade flow outcomes for developing country relative to high-income country members (Subramanian and Wei, 2007). Finally, an interesting, albeit puzzling result is that the evidence does not extend to all types of import-restricting policies subject to dispute. In particular, model estimates are consistent with the theory for disputes that challenge a respondent applying a policy on a "global" basis to all trading partners - e.g., disputes over trade-distorting internal taxes, subsidies, or domestic regulations that are nevertheless applied on a most-favored-nation (MFN) conforming basis. The framework does not explain dispute outcomes to the set of challenges over a respondent's policy applied on a "partial" basis which excludes imports from certain (non-complainant) foreign suppliers - e.g., disputes over WTO-inconsistent application of antidumping or countervailing duties or a preference scheme.

Overall, our results add to an emerging literature on international trade agreements, as a number of recent contributions demonstrate the empirical relevance of the terms-of-trade theory for the conduct and negotiation of trade policy across a variety of settings. Broda, Limão and Weinstein (2008) examine a set of *pre*-trade agreement levels of import protection and find evidence consistent with the theory that market power affects unilaterally-imposed or "best response" tariffs. Bagwell and Staiger (2011) examine a set of countries that newly acceded to the WTO between 1995 and 2005 and find that the negotiated, post-accession tariff levels that governments take on after joining the agreement are also consistent with the core theoretical predictions of what such negotiations can deliver. Ludema and Mayda (2013) find evidence that heterogeneity of exporter concentration can also be used to explain variation in the most-favored-nation tariff schedules for many of the long-term members of the GATT/WTO system as of the end of the Uruguay Round. Finally, Bown and Crowley (2013) focus on the time-varying resort to import protection through potentially permissible trade agreement "exceptions" and provide evidence consistent with a view of the WTO as a cooperative, self-enforcing agreement between governments that sometimes face pressure to adjust cooperative tariff levels in the face of trade volume shocks.[3]

[3] A more general survey of the economics literature on trade agreements is Maggi (forthcoming).

Our evidence also has implications for an evolving theoretical literature that explores the role of dispute settlement provisions in trade agreements modeled as incomplete contracts (Horn, Maggi, and Staiger, 2010). For example, Maggi and Staiger (2011, 2013, forthcoming) and Staiger and Sykes (2013a) model dispute settlement provisions as helping to fill in some of the gaps of the trade agreement's incomplete contract.[4] Our results suggest that one potentially important area for theory to continue to explore is the role of enforcement provisions in trade agreements that are both incomplete and motivated by the desire to coordinate policy changes in order to address terms-of-trade externalities. Finally, this paper also contributes to an empirical literature on GATT/WTO dispute settlement (Bown, 2004a) that used an earlier data sample to investigate related questions. While that research presented evidence consistent with the terms-of-trade theory, its reduced form estimation framework was not linked to any formal theoretical model.[5]

The rest of this paper proceeds as follows. Section 2 reviews the GATT/WTO institutional setting and the negotiating principle of reciprocity, as interpreted by Bagwell and Staiger (1999), and the resulting parallel definition arising in WTO dispute jurisprudence. Section 3 introduces a theoretical model derived from Bagwell and Staiger (2011). Section 4 describes the data used in the analysis and our empirical approach, and Section 5 turns to the econometric estimates. Section 6 concludes.

2 GATT/WTO Negotiations and Dispute Settlement

One of Bagwell and Staiger's (1999) critical theoretical contributions to the trade agreements literature was to establish the terms-of-trade externality as a central problem that such agreements are seen to solve. In order to establish this result, they provide a formal theoretical interpretation of the GATT/WTO principle of reciprocity.

The basic GATT/WTO principle of reciprocity arises in the text in two critical places. First, governments negotiate tariff reductions in GATT rounds under Article XXVIII *bis*,

[4] Another recent theoretical contribution is Beshkar (2010) which provides a mechanism design approach. Limão and Saggi (2008, 2013) present models in which they also explore different methods of enforcement of trade agreements. See also Ludema (2001).

[5] See also Bown (2004b) and Grinols and Perrelli (2006). Horn, Mavroidis and Nordstrom (2005) provide one of the early and important empirical papers on the economic determinants of WTO dispute settlement activity.

which contains clear language that participation is voluntary. While the Article XXVIII bis language indicates a desire for country negotiators to arrange "reciprocal and mutually advantageous" reductions in tariffs, there are no mandatory requirements for reciprocity to take place in the original GATT/WTO trade agreement negotiations. However, a second and formal application of reciprocity is found in the GATT rules for *renegotiation* of tariffs. Under Article XXVIII, a country is permitted to withdraw its previously granted tariff concessions and thus increase its tariffs. Nevertheless, if it and any adversely affected trading partner cannot come to an agreement as to a level of compensation that is due for such a tariff increase, reciprocity is understood as a limit to the tariff withdrawal (the retaliation response of the trading partner) to the amount that would balance "substantially equivalent concessions."

A key theoretical contribution of the Bagwell and Staiger (1999) model arises when they provide a mathematical interpretation for this concept of reciprocity, which they then use to derive implications for trade agreements. Their interpretation allows them to show how reciprocity helps to coordinate policy-changing behavior between two large countries starting from a prisoner's dilemma outcome in which both countries are imposing best response tariffs. They interpret reciprocity as coordinating tariff reductions so that the (own) adverse terms-of-trade impact of each country's import tariff reduction is neutralized by the positive impact it experiences through the trading partner's simultaneous import tariff reduction. The outcome (post-tariff reduction) in which each country imposes its "politically optimal" tariff maximizes joint (global) welfare because it achieves higher (and globally efficient) trade volumes relative to the trade volumes that arose under "best response" policies but without either country experiencing a change in its terms of trade.

What are the implications of this approach for the WTO's *enforcement* provisions? First, the original GATT/WTO enforcement texts also contain no explicit reference to reciprocity. Furthermore, in the case of a trade dispute in which the respondent country fails to comply with WTO rulings and the WTO must establish a limit to how much the complainant country is able to seek compensation through retaliation, the WTO's Dispute Settlement Understanding (DSU) states "[t]he level of the suspension of concessions or other obligations authorized by the [Dispute Settlement Body] shall be equivalent to the level of the nullifica-

tion or impairment." (GATT, 1994, Article 22:4). Thus, the DSU texts were initially unclear as to what would determine the limit to retaliation, such as whether it would also be limited by the principle of reciprocity.

Nevertheless, Bown (2002) notes that in practice the first two WTO disputes to reach the retaliation-defining stage of the WTO's dispute settlement process (*EC - Banana Regime* and *EC - Beef Hormones*) established jurisprudence which arguably adopted the Bagwell and Staiger (1999) formulation of reciprocity to define the limit to the tariff increase that a complainant country would be authorized to implement if the respondent did not remove the WTO-inconsistent policy. And while *stare decisis* and binding precedent are not as robust a feature of WTO law as other legal settings, Bown and Ruta (2010) show that the interpretations of the arbitrators in the *EC - Banana Regime* and *EC - Beef Hormones* disputes that limited retaliation to the level defined by the Bagwell and Staiger interpretation of reciprocity were not one-time events. They provide a detailed examination of the decisions in the 10 formal WTO disputes taking place between 1995 and 2008 that led to the phase in which the WTO arbitrators authorized and articulated retaliation levels and suggest that WTO arbitrators have consistently sought to define limits to authorized retaliation in a manner similar to this interpretation of reciprocity.[6] One implication that motivates our approach is that, during this period, respondent importing countries are likely to have had a good understanding of the upper limit of retaliation to which they may have found themselves subject if they refused to comply with WTO rulings.[7]

To summarize, the intuition for reciprocity in the enforcement setting is that, in a dispute, the complainant country would be authorized a tariff retaliation that would allow it to neutralize the terms-of-trade impact of the respondent country's original WTO violation. The simultaneous act under WTO dispute settlement of one country (the respondent) removing its WTO-violating policy in order to comply with a legal ruling and a second country (the

[6] Furthermore, in a number of instances in which arbitrators deviated from the definition, Bown and Ruta (2010) suggest that it was not necessarily due to a conceptual dissatisfaction with the Bagwell and Staiger definition but instead can be motivated by limits to data availability (e.g., services trade), measurement issues, or potentially different rules for limiting retaliation under different areas of WTO law, such as subsidies. Most of the disputes in the data set that we estimate below would not fall into these categories, had they reached the stage under which DSU arbitrators determined retaliation limits.

[7] See also the discussion in Schwartz and Sykes (2002) that interprets such retaliation limits as implying a "liability rule" remedy, and thus the implications for efficient breach of the trade agreement contract.

complainant) ending its WTO-authorized retaliation can be seen as neutralizing the terms-of-trade impact of policy changes, in just the same manner as two countries liberalizing tariffs simultaneously under original WTO agreement negotiations.[8]

The subsequent analysis is therefore motivated by insights from the underlying Bagwell and Staiger (1999, 2011) theory on reciprocity and its empirical implications for original trade agreement negotiations combined with recognition that WTO jurisprudence interpreted retaliation limits similarly in formal dispute settlement (Bown, 2002; Bown and Ruta, 2010). Our approach examines whether the empirical evidence of the Bagwell and Staiger (2011) trade agreement setting extends to the empirical setting of trade agreement enforcement. In the next section we more formally develop a theoretical model to guide the empirical examination in the remainder of the paper.

3 Theoretical Model

Bagwell and Staiger (2011) develop a multi-country, partial equilibrium model in which the domestic government can impose an ad valorem tariff τ on imports; domestic prices are thus defined as $p = (1 + \tau)p^w$ where p^w is the world price. The objective function of each government is defined as the weighted sum of producer surplus (PS), consumer surplus (CS), and tariff revenue, according to the equation:

$$W = \gamma PS(p(\tau, p^w)) + CS(p(\tau, p^w)) + (p(\tau, p^w) - p^w)M(p(\tau, p^w)). \tag{1}$$

In this equation $\gamma \geq 1$ reflects potential political economy pressure on the domestic government through a potential extra weight that the government places on producer surplus in its objective function, and $M(p)$ is the level of imports. Like Bagwell and Staiger (2011), we assume that W is globally concave over non-prohibitive τ. For this condition to be met even when the country is "small" (or $\partial p^w/\partial \tau = 0$), it must be the case that

$$W_{pp} < 0. \tag{A1}$$

[8] Put differently, if the respondent refuses to comply with the WTO ruling, reciprocity defines the limit to the complainant's retaliation as the amount that offsets the respondent's original terms-of-trade gain associated with violating the agreement.

This assumption is satisfied as long as demand is not too convex and supply is not too concave.

When the domestic government is unconstrained by trade agreements, we assume it chooses to impose its best response tariff (τ^{BR}) to maximize total domestic welfare:

$$W_p \frac{dp}{d\tau} + W_{p^w} \frac{\partial p^w}{\partial \tau} = 0 \tag{2}$$

Note that the partial derivative W_{p^w}, holding domestic prices constant, is equal to $-M(p)$. Thus this first order condition can be rewritten in the form:

$$-\frac{W_p}{p^{w,BR}} = \frac{\sigma^{BR}}{\omega^{*BR}} \frac{M^{BR}}{p^{BR}} \tag{3}$$

where σ^{BR} and ω^{*BR} are the (absolute value of the) elasticity of domestic import demand and foreign export supply faced by the domestic country, respectively, and the superscript BR denotes the levels of import volumes, world and domestic prices, and their trade elasticities, when evaluated at the best response tariff.

Following Bagwell and Staiger (2011), a second level of import protection worth highlighting is the country's politically optimal tariff, given by τ^{PO}. This is the level of protection the government would impose if it were not motivated by terms-of-trade considerations, and is thus defined as the tariff that satisfies

$$W_p(p^{PO}, p^{w,PO}) = 0 \tag{4}$$

where the superscript PO indicates the politically optimal level of domestic and world prices.

In a series of research, Bagwell and Staiger (1999, 2002) have shown how the GATT/WTO principle of reciprocity can improve global economic efficiency and deliver relief from the terms-of-trade driven prisoner's dilemma. The principle can be interpreted as one that allows countries to coordinate policies and thereby move from a noncooperative equilibrium in which governments impose best response tariffs (τ^{BR}) to a cooperative equilibrium in which governments impose their politically optimal tariffs (τ^{PO}). The reciprocity principle delivers this outcome because the coordinated movement serves to neutralize what would

otherwise be an adverse terms-of-trade impact of a unilateral import tariff reduction. In their empirical application, Bagwell and Staiger (2011) further develop this theoretical model in order to estimate determinants of how countries change their tariffs from their pre-WTO levels (interpreted as τ^{BR}) to their post-WTO accession levels (interpreted as τ^{PO}).

The approach we develop below will ultimately examine the relevance of this theoretical model for trade agreement enforcement negotiations that take place under dispute settlement provisions. This is motivated by our discussion in Section 2 that found stark parallels between the Bagwell and Staiger (1999) theoretical interpretation of reciprocity and its implications for trade agreement negotiations and how WTO jurists have interpreted the limits to permissible retaliation that can take place in WTO enforcement, or dispute settlement negotiations. We start the theory from the place that countries have signed onto a trade agreement, but nevertheless the domestic country has violated the agreement and once again implemented its best response tariff policy.[9] This country will then face a dispute and we seek to examine determinants of its policy decision to return to the politically optimal tariff.[10] In most all respects, we follow the Bagwell and Staiger (2011) modeling logic and intuition as they would transfer from the WTO agreements negotiations to the WTO enforcement negotiations. The one critical way in which our approach must differ from Bagwell and Staiger (2011) is that our empirical setting is complicated by the fact that, in most instances, governments do not deviate from the WTO agreement by simply implementing an observable best response tariff but instead some nontariff barrier.[11] Thus we use the remainder of this section to reformulate the Bagwell and Staiger (2011) approach to fit our setting and, in particular, observable data.

In order to motivate our empirical model, consider the simple linear version of the Bagwell

[9] We describe the theory in terms of a direct violation of the trade agreement. Nevertheless, especially since we are interested in measuring determinants of *trade volume* outcomes in lieu of policies, our approach should also apply to instances in which governments deviate from their trade agreement obligations through non-tariff policies, including domestic policies. It is possible under the WTO to pursue trade disputes in which no explicit WTO obligations were violated but which market access expectations have nevertheless been frustrated; such disputes are triggered by "nonviolation nullification and impairment" claims under GATT Article XXIII:1. For a discussion and one theoretical approach to nonviolation disputes under the GATT/WTO, see Staiger and Sykes (2013a, b).

[10] That is, we will not seek to model why it is that the country has already deviated from the politically optimal policy back to the best response policy. We simply take as given that the deviation has taken place and seek to examine determinants of the negotiations back to the politically optimal policy.

[11] Put differently, Bagwell and Staiger (2011) are able to empirically examine the relevance of the model for tariff negotiations because there is available data on pre-WTO accession and post-WTO accession tariffs.

and Staiger (2011) model. Domestic demand and supply are defined, respectively, by the following two equations:

$$D(p) = \alpha - \delta p \tag{5}$$

$$S(p) = \lambda + \kappa p \tag{6}$$

where both $\delta, \kappa > 0$. Further note that the W_p is defined by the expression:

$$W_p = (\gamma - 1)S(p) + (p - p^w)\frac{\partial M(p)}{\partial p}. \tag{7}$$

Finally, market clearing requires $M(p) = D(p) - S(p)$, which then yields a general formulation for import tariffs in the linear model as

$$\tau = \frac{[\alpha - \lambda] - M(.)}{p^w(\delta + \kappa)} - 1. \tag{8}$$

In the linear model, Bagwell and Staiger (2011) show that the terms-of-trade theory makes the following prediction for an estimating equation for politically optimal tariffs as a function of pre-negotiation (best response) tariffs, import volumes, and world prices

$$\tau^{PO} = \beta_0 + \beta_1 \tau^{BR} + \beta_2 M^{BR}/p^{w,BR}, \tag{9}$$

where $\beta_0 = [(\gamma - 1)\kappa(r - 1)]/\{r[\delta + \kappa - (\gamma - 1)\kappa]\}$, $\beta_1 = (1/r)$, $\beta_2 = -\theta/\{r[\delta + \kappa - (\gamma - 1)\kappa]\}$, $r \equiv p^{w,PO}/p^{w,BR}$, and $\theta \equiv (-\partial M/\partial p)/(\partial E^*/\partial p^w)$.[12] Furthermore, under the model's assumptions, it is straightforward to show that $\beta_0 \lesseqgtr 0$ as $r \lesseqgtr 1$ and $\beta_1 \lesseqgtr 1$ as $r \gtreqless 1$. Finally, $\beta_2 < 0$ since $\theta > 0$ and using $[\delta + \kappa - (\gamma - 1)\kappa] > 0$ by equation (A1). I.e., controlling for the level of the best response tariff, the negotiated (politically optimal) tariff will be lower the larger is the ratio of pre-negotiation import volumes to world prices, or $M^{BR}/p^{w,BR}$.

If data constraints were not an issue, the same approach could be adopted for our model of trade agreement *enforcement* negotiations that seek to have governments move from their best response policy to their politically optimal policy. Unfortunately an equivalent test of equation (9) is not empirically possible in the enforcement setting because the level of the best response policy deviation that becomes subject to dispute, τ^{BR}, is typically not

[12] In Bagwell and Staiger (2011), equation (9) is given by equation (12) on p. 1248.

observable in the data.

Our approach is to instead use information from equation (8) on how the politically optimal and best response tariffs relate to *observable* import volumes. We then substitute this into equation (9) in order to obtain an estimating equation to take to the enforcement data. Solving for an estimation equation of determinants of the politically optimal level of import volumes yields

$$M^{PO} = \psi_1 M^{BR} + \psi_2 (p^{w,PO} - p^{w,BR}) \tag{10}$$

where $\psi_1 \equiv 1+[\theta(\delta+\kappa)]/[\delta+\kappa-(\gamma-1)\kappa] > 1$, again because $\theta > 0$ and using $[\delta+\kappa-(\gamma-1)\kappa] > 0$ by equation (A1), and $\psi_2 \equiv -(\delta+\kappa)^2/[\delta+\kappa-(\gamma-1)\kappa] < 0$.

There are two key predictions that can be derived from the linear model and equation (10). First, the post-dispute volume of imports (M^{PO}) should be increasing in the (pre-dispute) best response volume of imports (M^{BR}). Second, the post-dispute volume of imports should be decreasing in the world price increase received by the foreign exporter in the *post-dispute* political optimum relative to the *pre-dispute* best response ($p^{w,PO} - p^{w,BR}$).

In more general and nonlinear models in which θ is not constant, we also follow the logic of Bagwell and Staiger (2011) so as to use available information from import demand and foreign export supply elasticities. That is, we can manipulate equation (10) in order to also estimate an equation of the following form

$$M^{PO} = \xi_1 M^{BR} + \xi_2 (p^{w,PO} - p^{w,BR}) + \xi_3 [\frac{\sigma^{BR}}{\omega^{*BR}} M^{BR}] \tag{11}$$

where $\xi_1 \equiv 1$, $\xi_2 \equiv -(\delta+\kappa)^2/[\delta+\kappa-(\gamma-1)\kappa] < 0$, and $\xi_3 \equiv [(\delta+\kappa)]/[\delta+\kappa-(\gamma-1)\kappa] > 0$ using equation (A1).

The interpretation arising under the more general model and equation (11) is the following. First, the parameter estimate on the best response volume of imports alone should be equal to 1. Second, the post-dispute volume of imports should again be decreasing in the world price increase received by the foreign exporter in the *post-dispute* political optimum relative to the *pre-dispute* best response. Third, the post-dispute volume of imports should be increasing in the *interaction* between the ratio of import demand to export supply

elasticities (σ^{BR}/ω^{*BR}) and the (pre-dispute) best response volume of imports.

The intuition behind this third prediction has two components. First, for a given best response volume of imports M^{BR}, the post-dispute level of imports is increasing in the elasticity of import demand, so that a given tariff decrease generates a larger increase in the quantity of imports demanded. Products with high import demand elasticities would be associated with large economic distortions associated with imposition of the best response tariff. Second, for a given best response volume of imports M^{BR}, the post-dispute level of imports is *decreasing* in the foreign export supply elasticity. I.e., the more market power that the importing country has vis-a-vis the exporter, or the larger is the inverse of the foreign export supply elasticity, the larger will be the politically optimal import volume. Put differently, note that the small importing country case corresponds to $\omega^{*BR} \rightarrow \infty$, in which the final term in equation (11) goes to zero, regardless of M^{BR} or σ^{BR}. Furthermore, in the small country limiting case, $p^{w,BR} \rightarrow p^{w,PO}$ and so by equation (11), $M^{BR} \rightarrow M^{PO}$. On the other hand, the smaller is ω^{*BR}, the greater is the responsiveness of foreign export supply to any given change from the best response to the politically optimal policy, and thus the larger the resulting post-dispute level of imports, ceteris paribus.

4 Data and Estimation

We rely on theoretically motivated equations (10) and (11) to ultimately estimate models of the form

$$M_{grc}^{PO} = \psi_1 M_{grc}^{BR} + \psi_2[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})] + \epsilon_{grc}, \text{ and} \tag{12}$$

$$M_{grc}^{PO} = \xi_1 M_{grc}^{BR} + \xi_2[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})] + \xi_3[\frac{\sigma_{gr}^{BR}}{\omega_{gc}^{*BR}} M_{grc}^{BR}] + \nu_{grc}, \tag{13}$$

where g indexes the disputes (products), r indexes respondent (importing) countries, c indexes complainant (exporting) countries, and ϵ_{grc} and ν_{grc} are the error terms. The theory suggests our estimates to be $\psi_1 > 1, \psi_2 < 0$, and $\xi_1 = 1$, $\xi_2 < 0$, and $\xi_3 > 0$.

4.1 Construction of WTO dispute sample

We begin with a population of 307 formal bilateral (complainant-respondent) WTO disputes that were initiated and concluded between 1995 and 2009.[13] We expand WTO dispute database of Horn and Mavroidis (2008) by adding years of additional disputes, and more details on policies under dispute and traded products now made available in Bown and Reynolds (2014). We begin with 1995 as that was the first year that the WTO and its Dispute Settlement Understanding was in effect, and we conclude in 2009 as we require three years of post-dispute trade data with which to observe potential changes in trade volumes resulting from the dispute settlement negotiations.

Given that our estimation framework requires information on the year by which the respondent has re-implemented its politically optimal policy, we require a rule for establishing the "conclusion" of a dispute. We define the politically optimal year, $t = PO$, in one of two ways. In 80 percent of our sample, the change in the policy is directly observed because of reports or filings in the dispute (e.g., mutually agreeable solutions), revelations through other official government documents (e.g., removal of temporary trade barriers), etc. In these disputes, we take $t = PO$ to be two years after this notification, so as to account for an implementation period and for trade flows to be given time to respond. However, in 20 percent of disputes there is no formal announcement of the policy change. In these instances, we take the politically optimal year $t = PO$ to be three years after the last legal correspondence between the two main litigants in the WTO dispute.

We need to identify two other critical years in order to estimate equations (12) and (13): (i) a year sometime *before* the initiation of the dispute, thus capturing a period before the respondent country has its best response policy in place and (ii) a year that the respondent country has its best response policy in place. The latter year is required so as to construct the data used in the estimation equations directly. The first year is required to construct the

[13] Overall, members filed 402 WTO disputes between 1995 and 2009. However, 53 were associated with alleged trade violations that were still in force as of 2009, while in another 42 disputes we were unable to confirm whether or not the policy under dispute was ever eliminated. Furthermore, we clean the population of redundant disputes (i.e., a complainant filing multiple disputes against the same respondent country over the same issue) and break into bilateral pairings any instances in which multiple complainants jointly file a dispute against a common respondent over the same issue. Because our model examines a setting in which enforcement negotiations take place bilaterally, we define our unit of observation as a complainant-respondent pair.

instruments that we use in the instrumental variables estimation described below. Of these two years, (ii) is straightforward and we take the year of the initiation of the dispute to be the year that the respondent country has its best response policy ($t = BR$) in place.

Ultimately, as described in further detail below when constructing our instruments used in the estimation, it is important to have information on the disputed market from a period prior to the respondent country having imposed its disputed policy, where we label the year that the disputed policy was initially imposed as $t = I$. While respondent countries are rarely alleged to have simply raised their applied tariffs, but instead are alleged to have imposed a WTO-violating policy through a nontariff barrier (which implies difficulty in measuring the *size* of the ad valorem equivalent of the policy change), constructing the timing of the imposition of the best response policy is relatively straightforward. In most instances, we identify the timing of the year of imposition of the best response policy either from official WTO documentation associated with the dispute or from official government notifications available from other sources.[14]

Table 1 describes the process by which the population of WTO disputes initiated and concluded between 1995-2009 is reduced to the sample that is appropriate and available for our modeling and estimation framework. Our first point is that the modeling framework that we have described in Section 3 is not necessarily appropriate for all disputes, especially those involving alleged violations to WTO rules affecting a country's export policies.[15] That eliminates 35 of the 307 disputes from consideration for the analysis. Second, we also eliminate from the sample disputes related to services imports or general policies that affect all imports, i.e., those that cannot be matched to any particular products under dispute. The resulting sample is 211 WTO disputes initiated and concluded between 1995 and 2009 that

[14] For an in depth analysis of the trade flows associated with products prior to the initiation of the dispute, see Bown and Reynolds (2014), where the years and sources of the information in each dispute are reported in the accompanying database. In the current paper, 22.3 percent of our sample includes disputes for which there was no policy change - i.e., the dispute arises under the allegation that the respondent has failed to bring itself into compliance with its basic WTO obligations either at the end of the Uruguay Round or after accession. In these cases, we define $t = I$ to be the year prior to the initiation of the dispute.

[15] For example, a three country model would be more appropriate to examine the litigation of WTO-inconsistent export subsidies, in which the complainant and respondent are each modeled as having exporters that compete in a common third market and which countries are assumed to have access to export policy instruments as opposed to the import tariffs assumed here. The examination of export restrictions would similarly require an alternative modeling framework that may include different assumptions on available policy instruments, and in that case the complainant would be the importer and the respondent would be the exporter of the disputed product.

relate to allegations over import policies that can be traced to HS-06 import products.

Our estimation procedure also requires matching available disaggregated trade data for volumes and prices for three critical years around the initiation and conclusion of the WTO dispute. We describe the matching process in greater detail in the next subsection, but our final sample of data used in the estimation includes 140 respondent/complainant pairs, or roughly two-thirds of the total population of 211 WTO disputes initiated and concluded between 1995 and 2009 that targeted imported products.

In our empirical analysis below, we ultimately explore the extent to which the model explains certain categories of disputes, depending on the countries involved, the type of policy under dispute, and the legal outcome of the disputes.

First, we explore whether our model better fits the high-income respondent subsample of data relative to the low-income importing countries, given that richer countries may have more market power. As Table 2 indicates, our sample of data contains a relatively wide cross section of high income and developing countries involved in WTO disputes.[16]

Second, we further categorize the caseload based on how the respondent's disputed import policy treated (non-complainant) third country exporters of the disputed product. The first type of dispute involves challenges to policies that the respondent imposed on a "global" basis against all trading partners. Examples would include a WTO-inconsistent internal tax, subsidy or domestic regulation that was nevertheless applied on a relatively MFN-conforming basis so as affect all exporters. The second type of dispute involves challenges to policies that the respondent imposed on a "partial" basis and thus which excluded certain third country exporters. Examples of partial policies would be WTO-inconsistent application of antidumping or countervailing duties or a trade preference scheme.[17] Table 1 indicates that

[16]Note, however, that there are no least developed countries in our estimation sample, though this is because least developed countries are mostly absent from involvement in WTO disputes altogether, so this phenomenon is not driven by our particular approach.

[17]To clarify, our categorization as to whether the disputed policy is "global" versus "partial" is based on our judgment of whether the policy excluded some, or was applied to all, third country (non-complainant) exporters of the disputed product. I.e., it is not based on whether the allegation focused on (or was limited to) legal arguments or submissions under GATT Article III (National Treatment versus Article I (MFN Treatment). Such a characterization would not be possible because some of the disputes in our sample do not move to the stage in which complainants must fully articulate their allegations of respondent misconduct. Furthermore, the two allegations are not mutually exclusive. For a discussion of some of the key economic aspects of National Treatment in the GATT and WTO, see Horn (2006). For a discussion of the role of MFN Treatment, see Horn and Mavroidis (2001).

in our final sample of 140 disputes, slightly less than half are associated with challenges to "global" policies, and the rest are associated with "partial" policies.

Third, we also explore whether trade disputes resolved through the WTO's legal system may have different outcomes than those that are settled prior to legal action. Table 1 also reports that a formal WTO Panel Report was issued in slightly more than half (80 out of 140) of the disputes in our sample.

4.2 Variable construction and data

Estimation of equations (12) and (13) requires data on trade quantities and prices associated with the products in each dispute. We take this information from a newly constructed database (Bown and Reynolds, 2014) which matches disputes to the c.i.f. value and volume (as measured by the net weight in kilograms) of bilateral import data by six-digit Harmonized System (HS-06) code from UN Comtrade.[18]

For each dispute we measure "world" or exporter-received *prices* for the product under dispute from data based on the ratio of the real value of imports associated with the dispute to the netweight (kilograms) of imports, deflating the nominal import value data using the IMF's world import price index. While we are interested in the impact of changes to prices received by foreign exporters, our unit values are constructed from importer data, which is more reliable than exporter-reported data but which is compiled on a c.i.f. basis and thus includes the insurance and freight costs that arise in getting from the exporter (complainant) to the importer's (respondent's) border. However, because our analysis focuses on changes in these unit prices, our estimates will be unaffected by differences in levels of these freight and insurance costs across products, provided these costs do not change substantially during the period of the dispute.[19]

[18] Disputes in our sample may target alleged WTO violations affecting products at a finer or more coarse level of aggregation than the HS-06. To the extent that disputes are over traded products at a finer level of aggregation, our approach may mismeasure the volume of imports. Neverthless, more than 70 percent of disputes in our sample target products measured at the HS-06 or more coarse level of aggregation.

[19] While freight and insurance rates are probably not time invariant during our sample, our results should be unaffected provided these changes are not correlated with changes in levels of trade protection. Nevertheless, because the error in the change in the exporter prices may be larger the longer is the duration of the dispute (i.e., the larger the difference between year $t = PO$ and $t = BR$), we include the change in crude oil prices to address change in transportation costs over the dispute period as part of our instrument.

Because weight data is not available for all HS-06 products, our approach is to drop any dispute in which volume data is not available for at least 80 percent of the HS-06 product lines. Of the remaining disputes, import volume data is available for almost all HS-06 product lines. For the handful of disputes without volume data for all HS-06 product lines, we drop those HS-06 products with a positive value of imports but missing quantity of imports. This approach provides the best assurance that our price variable, measured in dollars per kilogram, is calculated accurately. Nevertheless, this conservative approach forces us to drop an additional 66 disputes from the estimation sample because import volumes are unobserved or unrealistically low and likely mis-recorded.[20]

Exporter-received prices exhibit substantial variation in our sample due to the heterogeneous nature of the products across disputes. For example, the average exporter price associated with the disputes in our sample ranges from \$70 to \$587.20 per kilogram; across the disputes, the standard deviation of prices across all disputes is \$44.16 per kilogram. We deal with this heterogeneity in two ways. First, rather than estimating the equation using the change in the price level as suggested by equations (10) and (11), we estimate both equations by using the *percentage change* in the price. Second, we drop from the sample an outlier dispute in which price changes were abnormally large, and thus also likely associated with measurement problems.

Finally, the elasticity data used to estimate equation (13) is primarily derived from Crowley and Yu (2013). Crowley and Yu (2013) estimate import demand and export supply elasticities for a sample of 11 countries by HS-06 product lines between the years 1988 and 2012. Their estimates are calculated using the structural estimator originally proposed in Broda and Weinstein (2006) and further developed in Soderbery (2013). Dispute-level estimates of elasticities are calculated using a trade value weighted average of the HS-06 product line elasticities associated with each dispute. Crowley and Yu (2013) elasticities are unavailable for the HS-06 product lines and/or complainant countries for approximately 30 percent of our sample. In these cases we approximate the elasticities using the median elasticity in the product line of all other countries within the complainant country's World Bank income

[20] Theoretically, this approach could result in a sample selection bias if, for example, low-income countries are less likely to record import volume data than others. The proportions of low income respondents and complainants in our final sample, however, is virtually identical to those in the population of WTO disputes.

group.[21] In order to check the sensitivity of our results to alternative measures of elasticities, in the specifications reported below we also employ the export supply elasticities developed in Broda, Limão and Weinstein (2008) and the import demand elasticities developed in Kee, Nicita, and Olarreaga (2008).

Table 3 provides summary statistics for the variables used in the econometric analysis.

4.3 Instrumental variables estimation

Next consider our approach to estimating equations (12) and (13) and some of the econometric issues that arise. First, a strict interpretation of the model may omit factors that impact both the quantity of imports directly (through ϵ_{grc} in equation 12 or ν_{grc} in equation 13) and indirectly through its impact on changes to exporter prices, $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$. Examples would include non-captured import demand or foreign export supply shocks; if left unaddressed, this would lead to inconsistent estimates of ψ_2 or ξ_2.

We use instrumental variables (IV) to address this potential concern over endogeneity. In particular, we construct an instrument for the post-dispute change in exporter prices $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$ that is uncorrelated with ϵ_{grc} or ν_{grc}. Our instrument for $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$ is based on earlier changes in exporter prices for the disputed product - e.g., those that took place because of the original imposition of the allegedly WTO-violating policy. Specifically, if BR is the year that the respondent has its best response policy in place at the initiation of the dispute, and year I is the year that that policy is first imposed (with $I \leq BR$), our approach is to instrument for $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$ with $[ln(p_{grc}^{w,I-1}) - ln(p_{grc}^{w,BR})]$. We also follow Khandelwal (2010) and include the percent change in crude oil prices between the politically optimal and best response years as an additional instrument. In addition to being a potential supply shifter, this change in crude oil prices will control for changes in transportation costs over the period of dispute which are necessarily embedded in our calculations of export prices, as described earlier. To test for the quality of our instruments, we use standard tests for under-identification, weak instruments, and over-identification.

[21] Developing country respondents account for over three-quarters of the disputes in which we have to approximate elasticities, thus inducing more measurement error into this sub-sample of countries.

5 Econometric Results

This section reports econometric regression results from estimating equations (12) and (13) on a sample of WTO disputes initiated and concluded over the period 1995-2009.

5.1 Import volumes, exporter prices, and trade elasticities

Table 4 begins with estimates from the simple linear model of equation (12). The top half of the table presents estimates of the coefficients on the determinants of interest, and the lower half presents estimated elasticities of these same determinants taken at sample means.

The estimated coefficient on M_{grc}^{BR} in Table 4 is consistently statistically significant and positive across specifications, in line with theoretical expectations. In particular, the estimated coefficient of 0.86 in specification (1) implies an elasticity of 1.07, i.e., that a 1 percent increase in the best response (pre-dispute) volume of product g imports is associated with a 1.07 percent increase in the politically optimal (post-dispute) volume of imports.

Next consider the estimate for the coefficient on $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$, or the direct impact of changes in exporter prices. In the IV model in specification (1), the estimate of -0.46 is negative and thus consistent with the theory that the politically optimal volume of imports that arises at the conclusion of the dispute is decreasing, the larger is the price increase received by the foreign exporter of the disputed product associated with liberalization of the market. While the coefficient in the IV specification (1) is marginally insignificant at the 10 percent level, it is roughly twice as large as the OLS estimates presented in specification (2). This is consistent with the concern that unobserved demand shocks would cause the OLS estimates to be biased toward zero. Note finally that the first stages of our IV estimates are strong, with a Kleibergen-Paap F-statistic of 10.22.

We next re-estimate the IV model of specification (1) with only one modification – the introduction of an interaction term for the basic type of policy under dispute. We split the sample by categorizing disputes according to the way in which the respondent applied or excluded third (non-complainant) exporting countries from the policy. The first type of dispute concerns "global" policies and the second concerns "partial" policies. In their examination of a larger sample of WTO disputes and focus on pre-dispute data on the products

ultimately subject to formal litigation, Bown and Reynolds (2014) present suggestive evidence of potential different impacts on pre-dispute exporter price changes for "global" versus "partial" policies, with "global" policies resulting in larger decreases in export prices during the period between $t = I - 1$ and $t = BR$ in particular. We illustrate this distinction for our sample of data with Figure 2, which shows the mean growth rate of import volumes and foreign exporter-received prices for two underlying samples of disputes - those that challenge global versus partial policies.

Specification (3) of Table 4 therefore specifically allows for this potential distinction to enter the model by interacting exporter prices with two separate indicators in order to examine whether the price effects are significantly different across disputes involving partial versus global policies. Indeed, the estimates on the coefficient for exporter prices in specification (3) provide evidence of a sharp distinction: global policy disputes have a coefficient estimate on exporter prices (of -0.98) that is negative and statistically significant at the 1 percent level, indicating a strong negative relationship between increases in foreign export prices and the post-dispute politically optimal level of imports. On the other hand, partial policy disputes have a coefficient estimate on exporter prices that is not statistically different from zero. While there is no explicit theory as to why this differential should arise empirically across different types of disputes, nevertheless, we allow for these two types of disputed policies' impact on exporter prices to be different throughout the remainder of our estimates, and we further explore implications of such potential differences in more detail in a later section.

Specification (4) presents our first estimates derived from the more general model of equation (13). This specification introduces the theoretically motivated ratio of the respondent's import demand elasticity over the complainant's export supply elasticity interacted with the best-response volume of imports, i.e., $[(\sigma_{gr}^{BR}/\omega_{gc}^{*BR})M_{grc}^{BR}]$. The coefficient estimate on the interaction term is positive and statistically significant, which is consistent with the theory. The signs and the statistical significance of the estimates on the other coefficients are unchanged, though the coefficient estimates on $[ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})]$ and M_{grc}^{BR} are slightly smaller than in specification (3) once we include the interaction of M_{grc}^{BR} with the ratio of elasticities. However, the estimated elasticity of the full impact of M_{grc}^{BR} reported in the lower half of the table is 0.97 in specification (4), and is not statistically different

from 1. Next, column (5) simply re-estimates model specification (4) but using OLS, and thus without instrumenting for the change in the export prices. The coefficient estimates on exporter prices are again roughly half as large (-0.51) as they are when we use IV; the estimates on the other coefficients are unaffected.

The remainder of Table 4 explores the robustness of our results to alternative characterizations of the import demand and export supply elasticities, following the approach to sensitivity analysis suggested by Broda, Limão, and Weinstein (2008), in light of potential measurement error and outliers. In specification (6), we replace $(\sigma_{gr}^{BR}/\omega_{gc}^{*BR})$ with $ln(\sigma_{gr}^{BR}/\omega_{gc}^{*BR})$. In specification (7), we characterize the ratio of elasticities instead as a binary indicator variable taking on a value of one when the ratio is high and zero otherwise. In specification (8), we replace the HS-06 elasticities from Crowley and Yu (2013) with those from two different sources: the import demand elasticities from Kee, Nicita and Olarreaga (2008) and the foreign export supply elasticities from Broda, Limão, and Weinstein (2008).[22] Under each robustness check, the qualitative pattern of results is unaffected yielding evidence of a positive relationship between the ratio of elasticities interacted with the best response (pre-dispute) import volume and politically optimal (post-dispute) import volumes.

To summarize this section, our IV approach provides evidence consistent with the theory that the Bagwell and Staiger (1999, 2011) model of trade agreement negotiations also applies to the trade liberalization negotiations that take place under the WTO's formal dispute resolution procedures, at least for disputes over import policies applied on a "global" basis. First, the politically optimal (post-dispute) import volume is increasing in the best-response (pre-dispute) import volume with an estimated elasticity that is close to 1. Second, our instrumental variables approach indicates that the politically optimal volume of imports is also decreasing the larger is the price increase received by the foreign exporter of the disputed product associated with liberalization of the market. Third, post-dispute import volumes are also increasing in the ratio of the product's import demand elasticity to the foreign export supply elasticity. This is consistent with products for which the import demand elasticity is high – so that the alleged WTO-violating trade restriction was imposing significant (own)

[22]The export supply elasticities from Broda, Limão, and Weinstein (2008) are measured at HS-04 level and are for a different set of countries; thus we use the median elasticity in the country's World Bank income group to approximate the elasticities for roughly two-thirds of the sample. As a result, this specification uses a less precise measure of the elasticity associated with each dispute.

distortions on the respondent's importing economy – relative to a low foreign export supply elasticity. The qualitative pattern to the results is relatively robust to alternative ways of constructing and introducing the elasticity ratio into the model.

5.2 Retaliation capacity, interpreting magnitudes, and country incomes

Our results thus far have established the basic terms-of-trade model and estimating framework as useful for understanding the changes in trade volumes that result from trade liberalization negotiations taking place under WTO dispute settlement. This section extends the modeling structure in two ways to consider potential additional influences to dispute settlement outcomes arising in the data, and it provides a first interpretation of the relative magnitudes of the estimated coefficients.

First, our approach has been motivated by an attempt to stay as close as initially possible to the Bagwell and Staiger (1999, 2011) theory and empirical approach to modeling trade liberalization negotiations. Following the empirical application in particular, we have focused our analysis on the likely *within*-market implications of the terms-of-trade theory for the products under dispute, finding that greater trade liberalization (post-dispute import volumes) arises in disputes for products with (i) larger pre-dispute import volumes, (ii) smaller increases in exporter-received prices, and (iii) a higher ratio of its import demand elasticity to foreign export supply elasticity. We have also followed the Bagwell and Staiger (1999) interpretation of the GATT/WTO reciprocity principle, in our dispute settlement negotiations application this principle identifies (and limits) the size of the trading partner's retaliation threat to one that would neutralize the change in the terms-of-trade from what would otherwise be a unilateral liberalization by the respondent. However, by assumption, the complainant country in the theory is a sufficiently "large" importer from the respondent (in the other goods over which the potential retaliation would occur) so as to make this definition of reciprocity meaningful.[23]

In reality, bilateral trading relationship can exhibit asymmetries that may render mean-

[23] For an important theoretical contribution examining the role of bilateral trade asymmetries and enforcement of cooperative low tariffs in a repeated game model of trade agreements, see Maggi (1999).

ingless even WTO-sanctioned retaliation that a particular complainant country may be authorized to implement against a particular respondent.[24] To address the concern that potential variation across (post-dispute) politically optimal import volumes may be explained by differences in bilateral retaliation capacities, we introduce a variable defined as the respondent's total goods exports to the complainant as a share of the respondent's total goods exports to the world. We expect a positive relationship between this variable and the post-dispute volume of disputed product imports. The larger is the respondent's exports to the complainant as a share of its total exports, the more reliant is the respondent on the complainant for its exports, and thus the greater is the complainant's capacity to find and exert some meaningful trade retaliation threat to help facilitate respondent country compliance and trade liberalization as an outcome of the dispute negotiations.[25]

A second potential empirical concern is that there may be heterogeneity in the post-dispute import volumes associated with variation in the length of time that a dispute takes to get resolved. On one hand, we expect disputes that take longer to go from initiation to conclusion to be associated with larger post-dispute import volumes, due to economic growth in the rest of the economy.[26] On the other hand, disputes that last longer may take longer because of more complicated legal claims or politically sensitive reforms that would be associated with smaller post-dispute import volumes. Here we include a variable defined as the length (in years) between the initiation and the conclusion of the WTO dispute. In the next section, we further examine this issue by also considering the role of legal rulings and the formal dispute settlement process.

Column (1) of Table 5 thus introduces our preferred specification of the paper whereby

[24] While not part of our estimation sample because the underlying dispute involves a violation over trade in services, the canonical example in which the lack of retaliation capacity may be an important contributor to the inability of the respondent country to comply with adverse WTO legal rulings involves the tiny islands nation of Antigua and Barbuda dispute over Internet gambling brought against the United States. While there have been proposals that countries implement retaliation by something other than goods (tariff) retaliation, the reality is that as of this writing, there has yet to be a case in which a country actually *imposed* retaliation in some form other than tariff retaliation, partially because there are substantial implementation difficulties in doing so. For an extensive discussion of these issues, see the contributions in Bown and Pauwelyn (2010).

[25] We have utilized related variables considered by the literature, including the level of respondent exports to the complainant, and an interaction of these two variables, and the qualitative pattern of the results holds.

[26] In unreported robustness checks available from the authors, we have also included the respondent's real GDP growth between the years of initiation and conclusion of the dispute, as importer markets with higher overall levels of growth may also be associated with larger post-dispute import volumes. The qualitative nature of the results on the determinants of interest is unchanged.

we estimate equation (13) with our two new control variables. First, the coefficient estimate on the length of the dispute is positive, though it is not statistically different from zero. Second, the coefficient estimate on the complainant's bilateral retaliation capacity vis-à-vis the respondent is positive and statistically significant at 0.71. And the elasticity of 0.12 implies that a one percentage point increase in the share of its total exports that the respondent sends to the complainant is associated with a nearly one percent increase in the post-dispute import volume.

Column (2) expands the model specification of specification (1) by introducing a host of additional fixed effects to control for potential unobserved heterogeneity arising from a number of different sources. In particular, our results are robust to inclusion of respondent (importing) country, complainant (exporting) country, industry, and (politically optimal) year fixed effects, as the coefficient estimates are not significantly affected. Inclusion of politically optimal year fixed effects controls for the concern that import volumes may be abnormal in certain years for reasons unrelated to dispute settlement, e.g., due to events like the global trade collapse of 2008-9.

Figure 3 provides additional information on the relative magnitude of the estimates. Our approach is to first use the coefficient estimates from one particular specification to generate the predicted post-dispute volume of imports when the model is evaluated at the means of the data. We then consider, one at a time, a one standard deviation shock to each determinant of interest in order to examine changes in the predicted post-dispute volume of imports. Our comparisons consider three different model specifications: Table 5, specifications (1) and (2), and Table 4, specification (4), which does not include the retaliation capacity variable.

First consider Table 5, specifications (1) and (2). A product in a dispute over a globally-imposed policy with a one standard deviation lower change in price received by the foreign exporter (of 37 percentage points, see Table 1) is associated with 41-42 percent more post-dispute imports than the average. A disputed product with a one standard deviation higher ratio of the import demand elasticity to foreign export supply elasticity (of 19 percentage points, see Table 1) is associated with 32 percent more imports than the average. Finally, a relationship in which the respondent is more reliant on the complainant for its own exports (an import share that is 13 percentage points higher, see Table 1) is associated with 13-16

percent more imports than the average.

Next consider these estimated magnitudes in light of the estimated effects of the initial model specification (4) of Table 4, which did not control for the complainant's retaliation capacity. The effect of including the retaliation capacity variable does little to change the magnitude of the impact of the ratio of the elasticities (Figure 3) or the impact of the pre-dispute politically optimal import volume (not shown).[27] Failure to include retaliation capacity only seems to reduce the economic magnitude of the estimated impact of foreign exporter prices – the impact of a one standard deviation shock falling from 65 percent (Table 4, specification 4) to 41-42 percent (Table 5, specifications 1 and 2).

We use the remainder of Table 5 to estimate our preferred model specification on different subsamples of data based on income categories for the countries involved in the disputes. Columns (3) and (4) split the sample in two based on the income status of the respondent country, which, in our framework, is the importing country that has been alleged to have implemented a WTO-inconsistent trade restriction. Columns (5) and (6), on the other hand, split the sample in two based on the income status of the complainant (exporting) country that has initiated the WTO dispute. Given the relatively small sample of disputes, the purpose of this section is admittedly not to strictly test for differences in parameter estimates. Our more modest goal is to investigate whether country income status helps to explain the extent to which our basic modeling approach to trade liberalization negotiations under dispute settlement can potentially explain patterns in the data.

Table 5's specifications (3) through (6) clearly reveal that the evidence providing confirmation for the terms-of-trade theory's predictions is driven by the subsamples in which the complainant and/or the respondent is a high-income WTO member country. In particular, the best response (pre-dispute) import volume, the foreign exporter price change, the ratio of elasticities, and the retaliation capacity variable are each of the theoretically predicted sign and are statistically significant in the high-income country specifications (3) and (5). To the extent that high-income countries may be more likely to form trade agreements and initiate the enforcement provisions of trade agreements so as to neutralize terms-of-trade

[27] Even though the elasticity estimate for M_{grc}^{BR} is lower in Table 5 than in Table 4, the difference in the predicted impact of a one standard deviation increase in M_{grc}^{BR} above the mean prediction is small because inclusion of the retaliation capacity variable significantly increases the predicted post-dispute volume of imports.

externalities, these results are not surprising.

On the other hand, the model does not deliver results in line with the terms-of-trade theory's predictions in the developing country respondent (specification 4) or complainant (specification 6) subsamples. The smaller sizes for the developing economy samples may partially explain the lack of statistical significance of the determinants of interest, as may the fact that the elasticities are less precisely measured in this sub-sample as discussed above. However, a separate and theoretically-motivated explanation is that developing countries in particular may not seek to enter into trade agreements for terms-of-trade reasons in the first place, but instead if for time-consistency or bargaining reasons (Maggi and Rodriguez-Clare, 1998; Limão and Tovar, 2011) they lack the ability to unilaterally commit their private sectors to a policy of more liberal trade. While our approach does not provide a formal test of the commitment theory, our failure to find supportive evidence of the terms-of-trade theory for the subsample of developing countries is at least consistent with these countries pursuing trade agreements and its enforcement provisions for other motives. Furthermore, our evidence from WTO disputes is consistent with separate results in the literature that the WTO has differential trade effects for developing countries relative to high-income countries (Subramanian and Wei, 2007).

5.3 Potential differential effects across the WTO's dispute settlement process and policies

This section considers a number of additional estimates of the preferred specification on alternative subsamples of the dispute settlement data in order to investigate the role of the WTO's legal process and to alleviate some of the potential concerns that our results may be driven by selection bias. Table 6 presents the estimates.

Column (1) again presents estimates from our preferred model specification on the full sample of disputes, against which to benchmark the sensitivity analysis provided in the rest of the table. In specification (2) we drop a handful of disputes in which the WTO reached a legal ruling and determined that the respondent country was largely "innocent" and had not violated significant WTO provisions. In these disputes, we might not expect the respondent to offer significant additional trade liberalization and thus observe increases in post-dispute

import volumes. Put differently, we would like to rule out the possibility that our results are spuriously driven by the outcomes of disputes in which the respondent has not implemented a WTO-inconsistent import restriction in the first place. The robustness of our results in specification (2) eliminates this concern, at least with respect to the results for which the dispute reached the stage for which there was a formal legal ruling.

In specifications (3) and (4) we split the sample into two depending on whether or not the disputes reached the stage of the WTO issuing a formal legal decision, in the form of at least circulating a Panel report. Disputes that did not have at least a Panel report were either settled early or were dropped by the complainant. Specification (3) reveals that the subsample of disputes that received a legal ruling have estimates that are consistent with theoretical predictions and, for the most part, statistically significant. Furthermore, the estimates are generally larger and more consistently statistically significant than the estimates from the sample of disputes without legal decisions, which is reassuring for at least three additional reasons. First, the sample size of disputes without a legal decision is smaller than the sample that reaches at least a Panel report. Second, the subsample of disputes without a legal decision contains more observations with uncertainty as to the *timing* of policy changes, and this is likely to translate into additional measurement error for our variables constructed from the trade data.[28] Third, there is also the possibility that disputes without legal decisions were weaker disputes (i.e., the respondent more likely to have been innocent) and are ones for which our dispute settlement modeling framework for trade liberalization may not necessarily apply.

Next, specifications (5) and (6) split the sample into two depending on the nature of policy being challenged under the dispute - i.e., "global" versus "partial" policies. We have already described in detail the differential effects of the estimates of the foreign exporter price on post-dispute import volumes for these two types of disputes. However, it is also worth noting that the estimate on the ratio of the elasticities is statistically different for the global versus partial policy disputes as well.

In specifications (7) and (8) we split the sample exactly in two depending on whether the

[28] Recall that in such disputes we set $t = PO$ as three years after the last formal correspondence between the two litigating parties relating to the dispute.

complainant has a high or low retaliation capacity relationship with the respondent.[29] This is one way to investigate whether our estimation results assessing the impact of the terms-of-trade model are only derived from, say, high retaliation capacity bilateral relationships. While the estimates on the key determinants of the model are typically larger and more likely to be statistically significant in the high retaliation subsample of disputes, only the foreign export price variable interacted with the global policy indicator is not statistically significant in the low retaliation capacity subsample. Interestingly, the retaliation capacity variable itself is not significantly different from zero in the high retaliation subsample, suggesting that there may be a threshold level of retaliation capacity that a complainant may find necessary, but once that threshold is passed so that complainant can find some exports from the respondent over which to retaliate, additional capacity has little marginal effect.

Finally, specifications (9) and (10) split the sample exactly in two depending on whether the dispute involved high or low growth in import volumes between the best response year at the initiation of the dispute and the politically optimal year at the dispute's conclusion.[30] This is one way to investigate whether our results are being driven by the relatively "successful" (high import growth) or "unsuccessful" (low import growth) outcomes. The results are mixed. The ratio of import demand to export supply elasticities are statistically significant for both samples; however, the effects of foreign export prices and retaliation capacity appear limited to the low import growth disputes.

6 Conclusion

This paper examines the implications of the terms-of-trade theory for the enforcement of international agreements. Our approach extends the Bagwell and Staiger (1999, 2011) theoretical and empirical approach from the setting of original trade agreement negotiations to the setting of formal trade *dispute* negotiations.

We estimate the model on a new data set of the trade volume outcomes deriving from formal WTO disputes initiated and concluded between 1995 and 2009, and we provide evi-

[29] In particular, we split the sample at the median of our retaliation capacity variable, defined as the respondent's goods exports to the complainant as a share of its total goods exports to the world.

[30] In particular, we split the sample exactly in two based on the ratio of realized import growth relative to predicted import growth given the respondent's real GDP growth taking place over the same period.

dence that determinants of the trade flows that result from dispute settlement negotiations are consistent with theoretical predictions. In particular, larger post-dispute trade volume outcomes are associated with disputed products that have larger pre-dispute trade volumes, smaller increases to exporter-received prices, larger import demand and smaller foreign export supply elasticities. The results are economically significant and they are robust to inclusion of controls for asymmetries in bilateral retaliation capacities at the country level.

Nevertheless, our evidence from applying the terms-of-trade model to understanding dispute settlement outcomes does leave a number of unanswered questions. First is why this particular application fails to explain WTO disputes triggered by policies applied on a "partial" basis, whereby the respondent has excluded some third country trading partners from application of the disputed policy that it has applied against the complainant. A second question concerns the failure to find robust evidence of the model for the negotiated dispute settlement outcomes of developing countries. While this in itself may be consistent with other evidence from the literature that the impact of the WTO itself on trade volumes has differential effects for developing countries relative to high-income countries (Subramanian and Wei, 2007), it does not resolve the question of what specific purposes developing countries have in mind when they sign onto trade agreements like the WTO. While a theoretical motivation is that developing countries may be using the WTO as a commitment device vis-a-vis their private sectors rather than to neutralize terms-of-trade externalities (Maggi and Rodriguez-Clare, 1998; Limão and Tovar, 2011), it remains unclear how the external enforcement of this commitment device motive is implemented in practice if not through dispute settlement. A better understanding of these questions is an important area for future research.

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Table 1: WTO Disputes Initiated and Concluded, 1995-2009

	Number of disputes		Share of disputes in final sample	
Total WTO disputes (bilateral pair, non-redundant definition)	307			
- Disputes over policies that primarily affect exports		35		
Disputes over policies that primarily affect imports	272			
- Disputes over policies that primarily affect services imports		7		
Disputes over policies that primarily affect goods imports	265			
- Disputes over policies that affect general imports (no specific products listed)		54		
Disputes over policies that target imported products	211			
- Disputes in which we are unable to observe quantities and unit prices		66		
- Disputes in which we are unable to observe elasticities		4		
- Outliers		1		
Final Sample	140		100.0	
- Disputes in which the complainant (exporter) is high income		82		58.6
- Disputes in which the complainant (exporter) is developing		58		41.4
- Disputes in which the respondent (importer) is high income		88		62.9
- Disputes in which the respondent (importer) is developing		52		37.1
- Disputes over "global" policies that apply to all trading partners		65		46.4
- Disputes over "partial" policies in which some third country exporters are excluded from application		75		53.6
- Disputes which result in circulation of at least a Panel Report		80		57.1
- Disputes in which no legal ruling was issued		60		42.9

Table 2: WTO Dispute Participation by Country in the Sample, 1995-2009

	Complainants		Respondents	
Country	Number	Share of Total	Number	Share of Total
European Union	29	20.7	23	16.4
United States	21	15.0	45	32.1
Brazil	10	7.1	3	2.1
India	8	5.7	5	3.6
South Korea	7	5.0	8	5.7
Argentina	6	4.3	7	5.0
Canada	5	3.6	3	2.1
Chile	5	3.6	6	4.3
Mexico	5	3.6	6	4.3
Thailand	5	3.6	0	0.0
Turkey	0	0.0	5	3.6
Others	29	27.9	29	20.7

Table 3: Summary Statistics

	Mean	Std. Dev.	Min	Max
M_{grc}^{PO} (billions of kilograms)	0.67	2.43	0.00	26.47
M_{grc}^{BR} (billions of kilograms)	0.71	2.80	0.00	29.52
$ln(p_{grc}^{w,PO}) - ln(p_{grc}^{w,BR})$	0.09	0.64	-2.80	4.25
x Partial policy	0.09	0.48	-1.21	4.25
x Global policy	0.00	0.42	-2.80	2.76
$\sigma_{gr}^{BR}/\omega_{gr}^{*BR}$	9.95	18.73	0.20	145.65
Retaliation capacity of complainant	0.12	0.13	0.00	0.74
Duration of dispute	4.61	1.92	0.00	15.0

Table 4: Estimates of the Basic Terms-of-Trade Model of Post-Dispute Trade Volumes

	IV: Baseline (1)	OLS (2)	IV: add Global and Partial interactions (3)	IV: add elasticities (4)	OLS: with elasticities (5)	IV: modify elasticities (6)	IV: modify using elasticities indicator (7)	IV: replace with alternative elasticities (8)
Coefficient estimates								
M_{grc}^{BR}	0.86***	0.86***	0.86***	0.63***	0.62***	0.59***	0.56***	0.83***
	(0.04)	(0.04)	(0.04)	(0.08)	(0.09)	(0.06)	(0.07)	(0.05)
$\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})$	-0.46	-0.22						
	(0.30)	(0.14)						
$[\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})]$ x Global			-0.98***	-0.91***	-0.51**	-0.87***	-0.86***	-1.15***
			(0.18)	(0.15)	(0.20)	(0.17)	(0.17)	(0.29)
$[\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})]$ x Partial			0.16	0.24	0.07	0.20	0.13	0.30
			(0.16)	(0.22)	(0.07)	(0.18)	(0.13)	(0.32)
M_{grc}^{BR} x $(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$				0.02***	0.02***			
				(0.01)	(0.01)			
M_{grc}^{BR} x $\ln(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$						0.12***		
						(0.02)		
M_{grc}^{BR} x Indicator for high $(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$							0.32***	
							(0.07)	
Elasticities								
M_{grc}^{BR}	1.07***	1.03***	0.98***	0.97***	0.99***	0.98***	0.99***	0.98***
	(0.05)	(0.02)	(0.02)	(0.03)	(0.01)	(0.03)	(0.02)	(0.03)
$\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})$	-0.07	-0.03						
	(0.05)	(0.02)						
$[\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})]$ x Global			-0.01***	-0.01***	-0.00***	-0.01***	-0.01***	-0.01***
			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$[\ln(p_{grc}^{w,PO})$ - $\ln(p_{grc}^{w,BR})]$ x Partial			0.02	0.04	0.01	0.03	0.02	0.03
			(0.02)	(0.03)	(0.01)	(0.03)	(0.02)	(0.04)
$\sigma_{gr}^{BR}/\varpi_{gr}^{*BR}$				0.21***	0.22***			
				(0.07)	(0.08)			
$\ln(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$						0.20***		
						(0.05)		
Indicator for high $(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$							0.44***	
							(0.11)	
Observations	140	140	140	140	140	140	140	134
R-squared	0.95	0.96	0.96	0.97	0.97	0.97	0.97	0.96

Note: Robust standard errors in parentheses, ***, **, * denote statistically different from zero at the 1, 5, and 10 percent levels, respectively.

Table 5: Model Estimates with Retaliation Capacity and by Income Categories

	IV: Baseline (1)	IV: add fixed effects (2)	IV: High income respondents (3)	IV: Developing respondents (4)	IV: High income complainants (5)	IV: Developing complainants (6)
Coefficient estimates						
M_{grc}^{BR}	0.59***	0.59***	0.56**	0.93	0.57***	0.84***
	(0.07)	(0.05)	(0.06)	(0.65)	(0.07)	(0.12)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Global	-0.87***	-0.82***	-0.93***	-0.41	-0.95***	0.19
	(0.14)	(0.11)	(0.13)	(0.26)	(0.11)	(0.25)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Partial	0.15	0.09	0.94*	0.01	0.06	0.01
	(0.16)	(0.17)	(0.52)	(0.02)	(0.10)	(0.52)
M_{grc}^{BR} x $(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$	0.02***	0.02***	0.02***	0.05	0.02***	0.00
	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.01)
Retaliation capacity of complainant	0.71**	0.87*	0.59**	0.68	0.98**	0.25
	(0.28)	(0.53)	(0.27)	(0.44)	(0.42)	(0.16)
Duration of dispute	0.01	0.02	0.00	-0.01	0.01	0.00
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.00)
Elasticities						
M_{grc}^{BR}	0.80***	0.82***	0.78***	0.97***	0.75***	0.93***
	(0.04)	(0.03)	(0.05)	(0.07)	(0.05)	(0.08)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Global	-0.01***	-0.01***	-0.01***	-0.00***	-0.01***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Partial	0.02	0.01	0.12*	0.00	0.01	0.00
	(0.02)	(0.02)	(0.06)	(0.00)	(0.01)	(0.07)
$\sigma_{gr}^{BR}/\varpi_{gr}^{*BR}$	0.20***	0.20***	0.21***	0.33	0.20***	0.03
	(0.05)	(0.03)	(0.04)	(0.25)	(0.04)	(0.12)
Retaliation capacity of complainant	0.12***	0.15	0.10**	0.08	0.16**	0.04
	(0.05)	(0.09)	(0.05)	(0.05)	(0.06)	(0.03)
Duration of dispute	0.06	0.13	0.02	-0.05	0.09	0.03
	(0.05)	(0.15)	(0.09)	(0.04)	(0.07)	(0.03)
Respondent fixed effects	No	Yes	No	No	No	No
Complainant fixed effects	No	Yes	No	No	No	No
Industry fixed effects	No	Yes	No	No	No	No
Politically optimal year fixed effects	No	Yes	No	No	No	No
Observations	140	140	88	52	82	58
R-squared	0.97	0.97	0.98	0.65	0.98	0.93

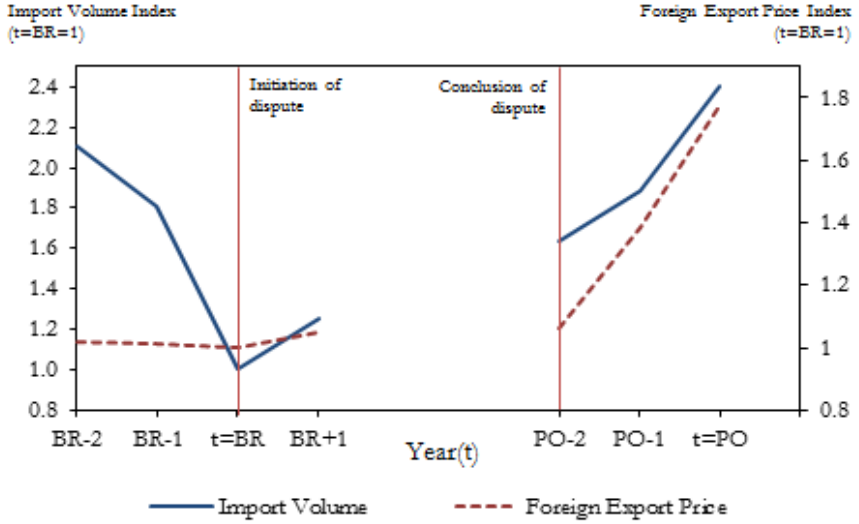
Note: Robust standard errors in parentheses, ***, **, * denote statistically different from zero at the 1, 5, and 10 percent levels, respectively. Elasticities in the lower half of the table all evaluated at the means of the full sample of observations in specification (1).

Table 6: Model Estimates and the WTO's Dispute Settlement Process

	IV: Baseline (1)	IV: Drop innocent disputes (2)	IV: At least Panel report (3)	IV: No Panel report (4)	IV: Global (5)	IV: Partial (6)	IV: High retaliation capacity (7)	IV: Low retaliation capacity (8)	IV: High import growth (9)	IV:Low import growth (10)
Coefficient estimates										
M_{grc}^{BR}	0.59***	0.59***	0.73***	0.55***	0.46***	0.81***	0.60***	0.47***	0.77***	0.51***
	(0.07)	(0.07)	(0.16)	(0.08)	(0.03)	(0.05)	(0.09)	(0.01)	(0.06)	(0.04)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Global	-0.87***	-0.87***	-0.86***	-0.51	-0.75***		-1.00**	-0.03	-0.04	-0.95***
	(0.14)	(0.14)	(0.11)	(0.43)	(0.19)		(0.05)	(0.06)	(0.05)	(0.06)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Partial	0.15	0.14	-0.04	1.49*		0.13	1.16*	-0.01	0.06	0.20
	(0.16)	(0.16)	(0.04)	(0.87)		(0.13)	(0.60)	(0.01)	(0.07)	(0.90)
M_{grc}^{BR} x $(\sigma_{gr}^{BR}/\varpi_{gr}^{*BR})$	0.02***	0.02***	0.01	0.01	0.03***	0.00	0.02***	0.01***	0.01**	0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
Retaliation capacity of complainant	0.71**	0.73**	0.25	0.70**	0.88	0.61**	0.35	1.26*	0.56	0.75**
	(0.28)	(0.29)	(0.39)	(0.31)	(0.78)	(0.24)	(0.25)	(0.71)	(0.47)	(0.29)
Duration of dispute	0.01	0.01	0.03***	-0.00	0.02	-0.01	0.01	-0.00	-0.00	0.02
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.00)	(0.01)	(0.01)
Elasticities										
M_{grc}^{BR}	0.80***	0.80***	0.81***	0.71***	0.74***	0.91***	0.73***	0.73***	0.90***	0.71***
	(0.04)	(0.04)	(0.05)	(0.12)	(0.07)	(0.03)	(0.07)	(0.10)	(0.08)	(0.13)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Global	-0.01***	-0.01***	-0.01***	-0.00	-0.00***		-0.01***	-0.00	-0.00	-0.01***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
$\left[\ln(p_{grc}^{w,PO}) - \ln(p_{grc}^{w,BR})\right]$ x Partial	0.02	0.02	-0.01	0.19*		0.02	0.13**	-0.00	0.01	0.03
	(0.02)	(0.02)	(0.00)	(0.10)		(0.02)	(0.07)	(0.00)	(0.01)	(0.13)
$\sigma_{gr}^{BR}/\varpi_{gr}^{*BR}$	0.20***	0.20***	0.10	0.15	0.28***	0.01	0.17***	0.12***	0.09**	0.12
	(0.05)	(0.05)	(0.10)	(0.12)	(0.03)	(0.07)	(0.05)	(0.04)	(0.04)	(0.07)
Retaliation capacity of complainant	0.12***	0.12***	0.04	0.12**	0.15	0.11**	0.05	0.27*	0.10	0.14**
	(0.05)	(0.05)	(0.06)	(0.06)	(0.12)	(0.04)	(0.04)	(0.12)	(0.08)	(0.06)
Duration of dispute	0.06	0.06	0.16***	-0.01	0.12	-0.04	0.08	-0.00	-0.00	0.12
	(0.05)	(0.05)	(0.06)	(0.15)	(0.09)	(0.04)	(0.09)	(0.03)	(0.04)	(0.08)
Observations	140	134	80	60	65	75	70	70	70	70
R-squared	0.97	0.97	0.99	0.80	0.98	0.96	0.98	0.94	0.99	0.77

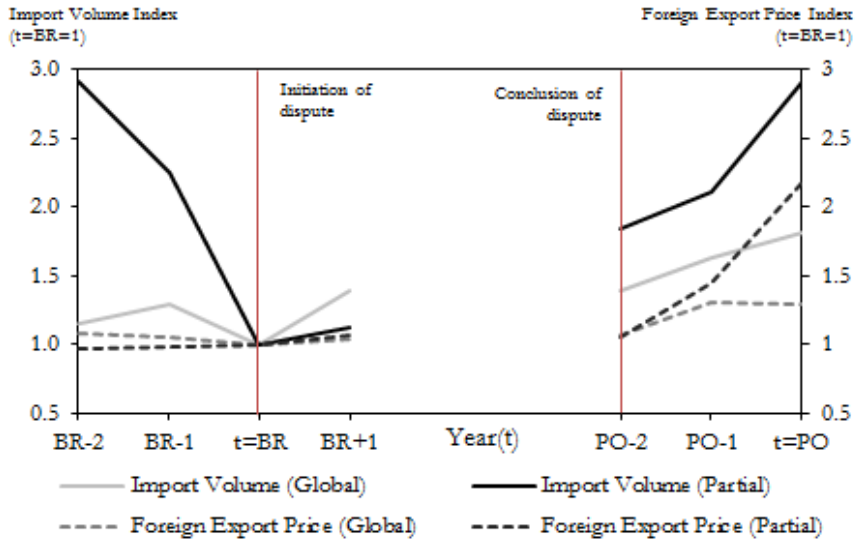
Note: Robust standard errors in parentheses, ***, **, * denote statistically different from zero at the 1, 5, and 10 percent levels, respectively. Elasticities in the lower half of the table all evaluated at the means of the full sample of observations in specification (1).

Figure 1: Average Import Volumes and Exporter Prices for Products Subject to WTO Dispute, 1995-2009



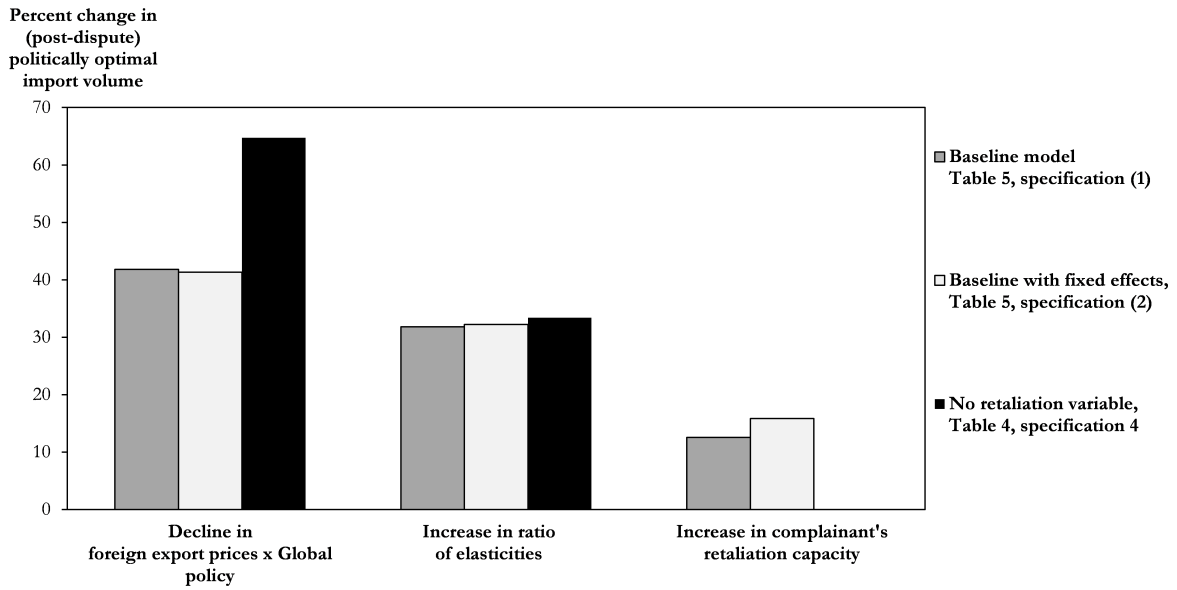
Note: Average volume of imports and foreign export prices for 140 disputes in the sample. Variables are first normalized by their values in the year that best response *(BR)* policy was in place, taken as the year of the initiation of the dispute. Year *I* (not shown) is the first year that the imposition of the disputed policy was in place, with $I \leq BR$. Year *PO* is two years after the conclusion of the dispute, the year the politically optimal *(PO)* policy was to have been re-imposed.

Figure 2: Average Import Volumes and Exporter Prices for Products Subject to WTO Dispute, Global versus Partial Policies under Dispute



Note: Average volume of imports and foreign export prices for 65 disputes concerning a global policy and 75 disputes concerning a partial policy. Variables are first normalized by their values in the year that best response *(BR)* policy was in place, taken as the year of the initiation of the dispute. Year *I* (not shown) is the first year that the imposition of the disputed policy was in place, with $I \leq BR$. Year *PO* is two years after the conclusion of the dispute, the year the politically optimal *(PO)* policy was to have been re-imposed.

Figure 3: Magnitudes of the Effects on Post-Dispute Import Volumes



Note: Percent increase in predicted (post-dispute) import volume relative to the predicted import volume with the model estimated at the means of the data. In each case, the approach is to use a one standard deviation change in each explanatory variable away from the sample mean, holding all other variables constant.